Joint Test and Evaluation Program

1999 Annual Report

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Abstract I am pleased to present the CY 1999 Annual Report of the Joint Test and Evaluation (JT&E) program. This program, now in its 27th year, continues to harness DoDs scientific, test, and analytical expertise to benefit our national defense. This has been an ambitious year for the JT&E program with nine chartered joint tests and two feasibility studies. In addition, during 1999 the program was realigned under the Director of Strategic and Tactical Systems. This report describes our CY 1999 accomplishments and plans for the future.	
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Foreword

I am pleased to present the CY 1999 Annual Report of the Joint Test and Evaluation (JT&E) program. This program, now in its 27th year, continues to harness DoD's scientific, test, and analytical expertise to benefit our national defense. This has been an ambitious year for the JT&E program with nine chartered joint tests and two feasibility studies. In addition, during 1999 the program was realigned under the Director of Strategic and Tactical Systems. This report describes our CY 1999 accomplishments and plans for the future.

The focus of the JT&E program is to identify realistic, cost effective, Service-implementable solutions for the problems facing today's warfighter. This focus, in line with warfighter activities in Kosovo and Iraq Northern Watch, had a significant influence on the FY 1999 JT&E selection process. The above activities, along with tensions in Korea, contributed to the establishment of two new feasibility studies. The first selectee, Joint Battle Damage Assessment, addresses shortcomings in our ability to assess the effectiveness of combat action. The second selectee, Joint Command and Control, Intelligence, Surveillance and Reconnaissance, investigates the ever-increasing challenge of integrating intelligence, surveillance, and reconnaissance systems into the command and control structure.

Ongoing joint warfighter issues also influenced the prioritization and subsequent chartering of two FY 1999 joint tests, Joint Cruise Missile Defense, which seeks to improve our defenses against cruise missiles, and Joint Global Positioning System Combat Effectiveness, designed to mitigate the vulnerabilities of the Global Positioning System. In addition, due to its criticality, one program scheduled for completion in FY 1999, Joint Suppression of Enemy Air Defenses, was extended to analyze, test, evaluate, and provide the warfighters proposed solutions to the lessons experienced during recent activities.

An increased emphasis was placed on accelerating results to the user earlier in the test process. Two ongoing programs, Joint Warfighter and Joint Theater Distribution, have already provided significant enhancements according to their warfighter CINC constituencies.

Two Joint Tests were completed on schedule in FY 1999. Their legacy products were transitioned to their respective user communities. Joint Forces Command adopted the analytical and modeling tools developed by the Joint Theater Missile Defense Joint Test into a formal organization, the Joint Theater Attack Analysis Center. Alaska Command adopted the Joint Combat Search and Rescue (JCSAR) templates and test methodology for use in stand-alone exercises and as guidance for integrating joint rescue operations into an existing training exercise. Additionally, multiple JCSAR training courses, used by numerous agencies in a variety of venues, will directly enhance our ability to train and perform JCSAR functions.

The success of the JT&E program is dependent upon significant Service and warfighter support throughout the life cycle of each project – from nomination through test execution to legacy transition. Their contributions have been consistent. Everyone supporting the JT&E

program is dedicated to keeping it relevant to the needs of the warfighter. As you read this annual report, I urge you to consider the unique capabilities of the JT&E program as a potential solution for your joint operational issues.

George R. Schneiter
Director
Strategic and Tactical Systems

Joint Test and Evaluation Program
1999 Annual Report

Table of Contents

Table of Contents
(continued)

NOTE: The author of each appendix is the respective Joint Test Director (JTD). This ensures the intent of the JTD is expressed with minimal editorial assistance.

The Joint Test and Evaluation Program

Introduction

Congress established the Joint Test and Evaluation (JT&E) Program in 1972 after a Presidential Commission concluded that the Department of Defense (DoD) had no capability to conduct test and evaluation in a joint environment. The Commission recommended that responsibility for joint testing be vested in the Office of the Secretary of Defense (OSD), which now exercises program leadership and publishes guidance in the form of DoD Directive 5010.41, handbooks, policy letters, and memoranda of agreement. The objectives of the JT&E program are to:

- Assess Service system interoperability;
- Evaluate joint technical and operational concepts and recommend improvements;
- Validate testing methodologies that have multi-Service applications;
- Improve Modeling and Simulation (M&S) validity with field exercise data;
- Increase joint mission capability, using quantitative data for analysis; and
- Provide feedback to the acquisition and joint operations communities.

The JT&E program integrates the expertise of the Defense science community and the experience of our warfighters to investigate and solve complex joint operational problems. The program applies rigorous test and evaluation methodology to provide timely solutions applicable to the joint military community.

The competitive nature of the JT&E nomination process ensures that the most important and operationally relevant projects are chartered. Each Service screens its nominations and then competes with the other Services for selection as a feasibility study and eventually for charter as a JT&E. The responsive decision cycle of the JT&E program, new nominations each year, one year to complete a joint feasibility study (JFS), and three-to-four years to complete a JT&E, gets timely, test-based results into the hands of the warfighter. A completed JT&E produces such legacy products as Joint Publications, multi-Service tactics, techniques, and procedures (TTP) manuals, and technical reports delivered to designated organizations as well as a database of all field test data. Joint Test Directors (JTDs) are also responsible to deliver interim results throughout their programs.

Each Joint Test (JT) is a temporary organization, established for the duration of its specific program. JTs are located where they can best accomplish their mission (see Figure 1), typically on major military installations of the lead Service. They are staffed with uniformed military personnel, U.S. civil service civilians, and technical support contractor employees. The emphasis for each JT is to establish a permanent legacy, not a permanent organization.

Customer organizations repeatedly express satisfaction with the JT&E Program, as in this September 1999 memorandum from the J3 of U.S. Forces, Korea:

> "...the program has already had a profound effect on this combined, joint command.... While JWF JT&E has already contributed to the improvement of our warfighting capability, we look for even greater benefits.... "

In regard to the Joint Theater Distribution JT&E, the J4 of U.S. Pacific Command (PACOM) stated in November 1999:

> "…The near and long-term improvements … hit the nail on the head and are precisely the help we needed to improve this theater's logistic and distribution process…."

The Congressional concerns that initiated the JT&E Program are especially valid today. Effective joint operations are no longer the aggregate of the Services' standalone warfighting capabilities. Commanders in Chief (CINCs) rely on the integration of Service capabilities, a task that the individual Services cannot address individually. With its rigorous methodology, organizational flexibility, and responsiveness, the JT&E program is uniquely prepared to assist decision-makers in solving these difficult problems.

JT&E Locations

9 Joint Tests, 2 Joint Feasibility Studies, 8 Locations

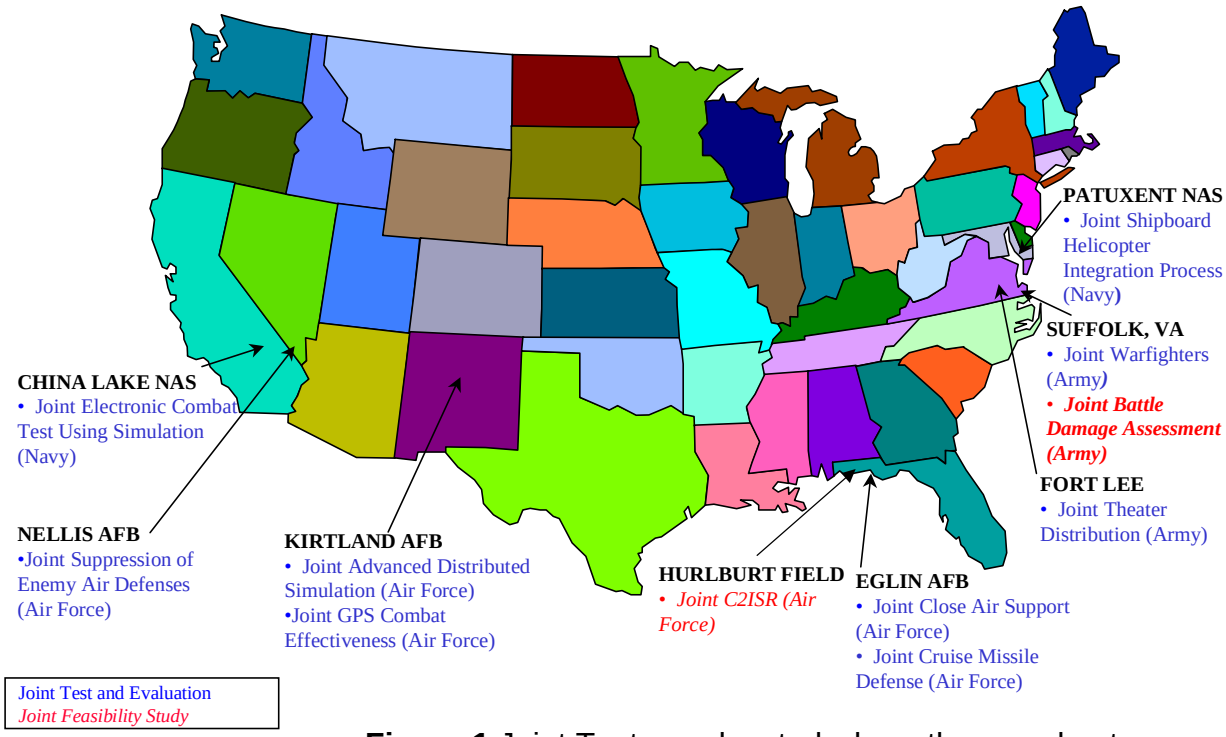

Figure 1 Joint Tests are located where they can best accomplish their mission.

1.0 Joint Test and Evaluation Program Accomplishments during 1999

During the 1999 calendar year, the JT&E Program addressed such timely and important missions as suppression of enemy air defenses, time-sensitive surface target attack, joint logistics distribution, and battle damage assessment.

The Services, Combatant Commands, and DoD Field Activities submitted six new nominations. After review and evaluation by the JT&E Program Office and a Planning Committee (PC), two nominations were considered by the JT&E Senior Advisory Council (SAC) and recommended as Joint Feasibility Studies (JFSs). They are Joint Battle Damage Assessment (JBDA) and Joint Command & Control (C2) Intelligence, Surveillance, and Reconnaissance (JC2ISR).

Two 1998 JFSs, Joint Cruise Missile Defense (JCMD) and Joint Global Positioning System Combat Effectiveness (JGPSCE), successfully demonstrated the necessity and feasibility of their programs and received OSD JT&E charters. A third 1998 JFS, Joint Missile Alert Broadcast System (JMABS), was withdrawn.

Seven Joint Tests (JTs), Joint Suppression of Enemy Air Defenses (JSEAD), Joint Close Air Support (JCAS), Joint Warfighter (JWF), Joint Theater Distribution (JTD), Joint Shipboard Helicopter Integration Process (JSHIP), Joint Cruise Missile Defense (JCMD), Joint Global Positioning System Combat Effectiveness (JGPSCE), Joint Advanced Distributed Simulation (JADS), and Joint Electronic Combat Testing Using Simulation (JECSIM), continued their activities, with completion dates scheduled from 2000 through 2004.

1.1 1999 Completed Joint Tests

Two JTs, Joint Combat Search and Rescue (JCSAR) and Joint Theater Missile Defense Attack Operations (JTMD-AO), completed their charters and transitioned legacy products to their customers.

1.1.1 ***Joint Combat Search and Rescue (JCSAR)*** completed its testing in 1998 by demonstrating the value of end-to-end JCSAR training during the JREX 98 field exercise. Evaluation of JCSAR effectiveness requires a large-scale operational JCSAR exercise that fully integrates the three functions of location and identification (Loc/Id), mission planning, and mission execution. No suitable exercise currently existed, so the JT planned and conducted a joint rescue exercise (JREX). The exercise plan, along with a documented set of lessons learned from the execution of JREX 98, serves as a template for a stand-alone exercise and as guidance for integrating joint rescue operations into an existing exercise.

During 1999, JCSAR focused on writing its final report and providing its test results to the warfighters and decision-makers. In addition, the JCSAR Team transferred legacy products designed to significantly improve training for JCSAR activities to various organizations. Those legacy products included improved Survival, Evasion, and Recovery multi-Service Tactics, Techniques and Procedures (TTPs) and training courses such as: a *Joint Search and Rescue Center Controllers Course,* a *Survival, Evasion, Resistance and Escape Course,* and an *Airborne Mission Commander*

Training Syllabus. In addition, the legacy transition team assisted the Alaska Command (ALCOM) in conducting an end-to-end JCSAR training and evaluation during the 1999 Cope Thunder Exercises. ALCOM will continue to use the JCSAR legacy in future years.

1.1.2 ***Joint Theater Missile Defense Attack Operations (JTMD-AO)***, having completed its testing in 1998, finalized its legacy products, prepared the final report, and briefed the final results of the test during 1999. Joint Forces Command (JFCOM) and the Air Force considered the JTMD-AO analytical capability and models so important that they jointly committed resources to establish the JT legacy as a permanent organization. The Joint Theater Attack Analysis Center (JTAAC), a JFCOM organization, was formed from the core of the JTMD-AO JT. JFCOM chartered the JTAAC as its sponsor with the Air Force serving as the Lead Operational Authority and Lead Service. The JTAAC charter established the JTAAC to employ multi-Service equipment and personnel to conduct training, experimentation, and analysis of the capability of U.S. forces to conduct theater missile defense attack operations employing weapon systems focused on both near- term, 5 years, and far-term, 15 years, solutions.

1.2 Current Joint Tests

The seven on-going and two new JTs address critical mission issues validated by the situations in Korea, Iraq, and Kosovo, and by the need to improve the combat effectiveness of targeting processes. They also focus on proactive issues such as the emerging cruise missile threat and our reliance on the global positioning system for precision navigation and timing, as well as investment strategies for validating modeling and simulation for improved efficiency and effectiveness in training and testing.

1.2.1 The *Joint Suppression of Enemy Air Defenses (JSEAD)* Joint Test benefits the warfighter with more effective suppression of enemy air defenses and improved processing of information from the intelligence, surveillance, and reconnaissance (ISR) architecture by assessing current SEAD and ISR capabilities, and testing and evaluating potential improvements.

Since the Gulf War, U.S. JSEAD strategy has emphasized destructive, preemptive targeting to destroy an enemy's integrated air defense system (IADS). However, as enemy IADS threats have become more sophisticated and mobile, it is increasingly difficult to target them preemptively, making an effective *reactive* JSEAD capability a necessity. The Office of the Secretary of Defense chartered the JSEAD JT in September 1996 to characterize the reactive JSEAD targeting process, baseline current capabilities, quantify element contributions to that process, identify deficiencies, and test and evaluate potential improvements. The Air Force is the lead Service.

The JSEAD test accomplishes its charter by collecting data during Joint and Serv-

Figure 1-1 Mobile enemy IADS threats are increasingly difficult to target.

ice training exercises, developing enhancements to the reactive SEAD targeting and ISR processes, then testing those enhancements in realistic exercise environments.

During 1999, the JSEAD JT completed a detailed analysis of its 1998 test results and provided several timely products to our warfighters, including:

- An early draft of the *JSEAD Interim Report* to key planners of Operation Allied Force during the early stages of operations over Kosovo,
- An evaluation of ISR, command and control, and IADS attack operations for Operation Northern Watch over Iraq, and
- Deficiency reports about data corruption and problems in threat training equipment to system owners.

In 1999, JSEAD completed a highly successful Data Management Exercise during a Mission Employment exercise at the USAF Weapons School as a rehearsal for LIVEX 2000.

JSEAD had planned for two final test events, Computer-Assisted Exercise 99 (CAX 99) and Live-Fly Exercise (LIVEX 99), which were canceled at the last minute due to unanticipated urgent commitments and increased OPSTEMPO. Cancellation of these tests prevented the JT from fulfilling its charter requirements as originally scheduled.

The JSEAD team explored feasible alternatives for successful completion of the program and presented them to the SAC in June. The conflicts in Iraq and the Balkans in combination with the 1998 JSEAD test results clearly attested to the need to continue the JT to charter completion. The SAC rated the JT as its top priority and recommended an extension to September 2001 to allow completion of a final LIVEX in August/September of 2000.

Out of these final tests, JSEAD will provide the following legacy products to the warfighter upon program completion in 2001:

- Changes to joint doctrine manuals;
- A multi-Service tactics, techniques, and procedures manual with the Air Land Sea Application Center;
- Changes to Air Force tactics, techniques, and procedures 3-1 series manuals; and
- Organizational recommendations, training plans, a flag officer leader development module, a *Commander's Guide for JSEAD Campaign Planning*, and a master database of test event information for OSD, JFCOM, and the Services.

Additional information about JSEAD is available in Appendix A.

1.2.2 The *Joint Close Air Support (JCAS)* Joint Test benefits the warfighter with improved Close Air Support (CAS) by benchmarking current CAS operational effectiveness, developing improvements, and assessing those improvements to provide updated tactics, techniques, procedures, and more efficient application of current technology, and reduced fratricide.

Since the last JT of CAS tactics, techniques, and procedures more than a decade ago, both ground and air forces have adopted new weapons and support systems technologies. As the interactions among ground and air support forces have evolved, the corresponding CAS tactics, techniques, and procedures have developed in an ad hoc manner. The Office of the Secretary of Defense chartered the JCAS JT in August 1997 to assess the current capabilities of U.S. forces to conduct joint close air support in day, night, and adverse weather conditions,

and suggest potential improvements. The Air Force is the lead Service.

JCAS conducts its test by collecting field data during routine Army training rotations at the National Training Center (NTC), Ft Irwin, CA. The JCAS team then develops potential improvements and assesses them during field training exercises, also at the NTC.

In 1999, the JCAS JT began its first field test, conducted a mini-test, and completed an interim report with conclusions from its November 1998 mini-test.

- The field test, which started in March 1999 and finishes in May 2000, is establishing the baseline effectiveness of current day CAS procedures by observing Army maneuver units in free-play exercises against the Opposing Force (OPFOR) during rotations at the NTC;
- The mini-test measured forward air controller (FAC) ability to control CAS aircraft at medium altitude in daylight operations and
- The *Interim Test Report* provided warfighters with important analysis of the November 1998 mini-test data, which identified problems with the requirement for "positive control" during day CAS operations.

Figure 1-2 JCAS collects data during Army training rotations at the National Training Center.

When JCAS is complete in 2003, its legacy products will include:

- Baseline effectiveness data of current close air support capabilities;
- Alternative joint tactics, techniques, and procedures; and
- Suggestions for improved equipment and increased interoperability.

Additional information on JCAS is available in Appendix B or on the Internet at http://jcas.eglin.af.mil.

1.2.3 The *Joint Warfighters (JWF)* Joint Test benefits the warfighter with improved time-sensitive surface targeting by baselining current processes, developing enhanced processes, and testing the enhancements to provide through more effective and efficient targeting; better interoperability, streamlined coordination, deconfliction, synchronization, and truly joint doctrine and tactics, techniques, and procedures.

The prosecution of time-sensitive surface targets (TSSTs) has often been cited as deficient, and difficulty in prosecuting TSSTs appears to be a common problem. Parochial Service interests in the joint application of firepower can be traced to World War II and are still being debated. This is reflected in the "Roles and Missions" debate among the Services over proposed joint doctrinal publications that address the command and control of firepower. However, the critical nature of engaging TSSTs must be resolved and can be addressed outside the roles and missions debate. OSD chartered the JWF JT in 1997 to investigate, evaluate, and improve the operational effectiveness of joint operations against time-sensitive surface targets. The Army is the lead Service.

JWF accomplishes its program objectives by collecting baseline TSST process data during joint exercises and developing potential enhancements to those processes.

The enhancements are then assessed during future Joint exercises in a manner that allows direct comparison with the baseline processes to determine if there is an improvement.

In 1999, the JWF JT continued collecting and analyzing baseline process data for TSST attack, conducted planning to prepare for the assessment of enhanced TSST processes starting in 2000, and disseminated the following interim test results to numerous customers.

- Collected baseline process data during the Ulchi Focus Lens (UFL) command post exercise in the Republic of Korea.
- Provided an interim report to U.S. Forces, Korea (USFK) from the 1998 UFL exercise which USFK used to revise the procedures in the Deep Operations Coordination Cell.
- Participated as observers for JFCOM during Theater Missile Defense Initiative.
- Published *The TSST Monograph, Workarounds During Desert Storm* in the proceedings of the Joint Warfighting conference at the Royal United Services Institute, London.
- Participated in two *Joint Publication 3-60 (Joint Doctrine for Targeting)* working groups as technical review authority for the publication.
- Submitted an article on UFL support to the *Air-Land-Sea Bulletin*, the newsletter of the Air-Land-Sea Application Center (ALSA).
- Published a newsletter, *Warfighting Times*.

The JWF Legacy Team has identified potential products to be provided to the warfighter when the JT&E is complete in 2002. They include:

- A compendium of data supporting JWF findings and outcomes for the Joint Staff, Combatant Commands, the Services, and operational units;
- Recommended changes to specific joint publications for the Joint Staff, the Services, and DoD Field Activities;
- Potential enhancements to the training of individuals, Joint Task Force (JTF) Component Command staffs, and Service staffs in prosecuting TSSTs;
- Recommendations for developing or modifying materiel systems to enhance TSST attack effectiveness;
- Recommendations for JTF organization for the command and execution of fires, documenting the various organizational structures currently in use; and
- Development of a monograph, discussing the most notable problems encountered during Desert Storm when prosecuting TSSTs.

Figure 1-3 Several Joint Tests, including JWF, JSEAD, JCAS, and JCMD, are assessing the targeting process.

Additional information on JWF is available in Appendix C or on the Internet at http://www.jwf.jte.osd.mil.

1.2.4 The *Joint Theater Distribution (JTD)* Joint Test will benefit the warfighter with improved logistic response times by assessing current theater Service distribution systems' capabilities and exploring potential solutions to identified shortfalls in order to increase the visibility of materiel in the distribution pipeline, recommend improvements to physical distribution networks, integrate automation tools, and eliminate the need for ad-hoc process work-arounds.

Recent military operations have highlighted the difficulties in managing in-theater logistical distribution, the related information flows, and the integrated management processes necessary for the Joint Force Commander (JFC) to execute required Title 10 directive logistics authority. The JTD JT was chartered in 1998, with the Army as the lead Service, to employ multi-Service and other DoD agency support, personnel, and equipment to assess DoD in-theater distribution systems. The JT will then enhance theater distribution through the application of improved business practices.

During 1999, in its first full year since being chartered in September 1998, JTD has organized the joint test team, collected preliminary information from the PACOM and EUCOM theaters, and planned future tests. These 1999 activities included:

- Continued acquisition of the manning and equipment necessary for the JT;
- Initial mapping of the PACOM and EUCOM in-theater distribution nodes to baseline current processes and measures of effectiveness;
- Detailed site plans for PACOM and EUCOM in preparation for test activities in 2000; and
- An interim legacy product in the form of a "Distribution Manager's Operational Architecture," which has already been incorporated into the PACOM CINC 21 project.

The Deputy Joint Test Director has been assigned the responsibility for the development of a Legacy Plan that will describe JTD JT products, their implementation, how they will be institutionalized, and the transition of those products to the customer. A General Officer Steering Committee will recommend the direction of product development and facilitate institutionalization. Upon program completion in 2002, JTD expects to produce the following types of legacy products:

- *Improved business processes*, assessing current theater Service distribution systems' capabilities and exploring solutions to identified shortfalls;
- *Distribution system improvement*, with analysis of the theater distribution pipeline focused on nodal processes; and
- *Training*, using the modeling tool and associated analytical data developed throughout the JT&E for the development of future joint and Service logistics management training courses.

Figure 1-4 JTD has conducted initial mapping of the PACOM and EUCOM in-theater distribution nodes.

Additional information on JTD is available in Appendix D or on the Internet at http://www.lee.army.mil/jtejtd/.

1.2.5 The *Joint Shipboard Helicopter Integration Process (JSHIP)* Joint Test increases warfighter readiness to conduct joint shipboard helicopter operations. JSHIP will develop and test a shipboard helicopter certification process and use the collected data to certify specific ship-helicopter combinations. Additionally, the test data will support a test and evaluation, training, and modeling and simulation (M&S) process that will replicate the helicopter take off and landing tasks/characteristics aboard a ship. This simulation will not only establish acceptable fidelity criteria, but also provide a process for ship-helicopter M&S validation, verification, and accreditation. JSHIP findings will standardize and improve ship-helicopter procedures, training, and compatibility, and update related tactics, techniques, and procedures (TTPs), making ship-helicopter operations safer and more effective.

Figure 1-5 Joint helicopter shipboard operations have become a routine part of joint operations.

Joint helicopter shipboard operations have become a commonplace occurrence. The current lack of coherent, integrated, and standardized TTPs restricts the Joint Force Commander's options during contingency operations. Waivers are routinely required to authorize Army and Air Force ship-helicopter operations that have not been previously evaluated. These operations may be further restricted due to the absence of information regarding electromagnetic interference between ship and/or aircraft electronic systems and the equipment and armament they carry that significantly impact interoperability.

OSD chartered JSHIP in 1998 and selected the Navy as the lead Service, with the Army and Air Force as participating Services. JSHIP will address compatibility, procedures, and training issues related to the safe conduct of joint shipboard helicopter operations. The JSHIP focus is to develop a process for certification of Army and Air Force helicopters to operate onboard Navy ships.

During 1999, JSHIP successfully completed the review and approval of its test planning documentation and initiated at-sea testing. This first at-sea test:

- Successfully assessed the interoperability of Army UH-60A Blackhawk and CH-47D Chinook helicopters with the Amphibious Helicopter Assault Ship, USS Saipan (LHA-2),
- Collected ship air-wake modeling and visual cueing simulation data for the Dynamic Interface Modeling and Simulation System (DIMSS), and
- Collected data to address issues involving compatibility, procedures, training, and interoperability of Army helicopters aboard LHA-class ships.

The JSHIP integration process will baseline current joint shipboard helicopter

capabilities and test twelve ship-helicopter combinations to identify, verify, and establish the process, certify the ship-helicopter areas evaluated, and provide recommendations
and enhancements to Service directives addresing TTPs and interoperability.

At the conclusion of JSHIP in 2002, the following legacy products will be provided:

- *Process products*, providing revisions to Joint and Service doctrine/training documents, the JSHIP test data base, and a template for future joint ship/helicopter testing;
- *Waiver-reduction/elimination*, providing ship/helicopter certifications and other critical data for joint naval helicopter operations, and
- *DIMSS products*, providing field data for use in flight simulator training and engineering testing.

Additional information on JSHIP is available in Appendix E or on the Internet at http://www.jship.org/.

1.2.6 The *Joint Cruise Missile Defense (JCMD)* Joint Test provides the warfighter with a better understanding of vulnerability to the cruise missile threat by characterizing the current and near-term effectiveness of a typical U.S. Joint Integrated Air Defense System (JIADS) to counter a cruise missile attack, and by assessing evolving capabilities to address the JCMD mission area.

The cruise missile threat to U.S. forces is present and increasing while Joint cruise missile defense (CMD) concepts of operation and tactics, techniques, and procedures require revision due to the insertion of emerging technologies and the evolving threat. This deficiency is a potential shortfall in current U.S. warfighting capability. OSD chartered the JCMD JT in July 1999 to identify, test, and assess current and enhanced processes associated with joint operations as they influence CMD mission accomplishment. JCMD will focus on the five elements in the JCMD kill chain: detection, tracking, identification, allocation, and engagement. JCMD is scheduled for completion in 2004 with the Air Force as the lead Service.

During 1999, the JCMD JT began staffing its organization, arranging for facilities, planning the JT, and preparing for the initial tests. Specifically, the team:

- Prepared program planning documents and distributed the first draft of the Program Test Plan (PTP) in November.
- Assembled a test team to conduct the first JCMD field activity, a mini-test (MT) scheduled for March 2000 in conjunction with the All Service Combat Identification Evaluation Team (ASCIET) annual evaluation; and
- Continued the development of a memoranda of agreement (MOA) to collaborate on testing and support during the MT.

Figure 1-6 JCMD will utilize the BD5-J mini-jet as a cruise missile surrogate

JCMD legacy products will provide warfighters with a baseline effectiveness evaluation of current JIADS capabilities and procedures in the JCMD mission area. Once this has been accomplished, the JT&E will quantify the effects of TTP and CONOPS changes as well as C2, sensor, and shooter systems enhancements to the JIADS in the CMD role. These products include:

- JCMD-evaluated baseline and enhanced mission capabilities,
- Interim capabilities reports and briefings,
- Updated cruise missile and defensive systems data for establishing the JCMD simulation architecture which will evaluate potential changes to CMD capabilities,
- Inputs for TTPs and CONOPS,
- Test methodology to assess future CMD technologies and capabilities,
- Interim test report six months after each major test event,
- Required JT&E test reports and briefings; and
- JCMD simulation architecture legacy transition with a major legacy customer, tentatively PACOM.

Additional information on JCMD is available in Appendix F.

1.2.7 The *Joint Global Positioning System Combat Effectiveness (JGPSCE)* Joint Test (JT) benefits the warfighter by assessing the ability of joint forces to accomplish their objectives in the event GPS reception is degraded or denied, by determining the impact of GPS vulnerabilities on missions that require precision engagement, and by identifying means to maintain combat effectiveness.

Warfighters are increasingly reliant on GPS. The impact of the loss or degradation of GPS capabilities and the ability to operate despite that loss or degradation has not been systematically tested or evaluated in a joint operational environment. In July 1999, OSD chartered the JGPSCE JT to evaluate the impact that electronic warfare might have if targeted against our forces using GPS and the ability of our forces to maintain operational effectiveness in the face of such electronic warfare by using improved tactics, techniques, and procedures. The JT will also assess the vulnerability of systems to loss of GPS. JGPSCE is scheduled for completion on 2003, with the Air Force as the lead Service.

In 1999, JGPSCE commenced detailed program planning, prepared for participation in critical external events, and prepared memoranda of agreement with supporting organizations, including the following:

- Commenced development of the PTP using the initial cadre of contractor personnel. JGPSCE members traveled to various locations to gain insight into GPS applications, operational situations, and test venues;
- Conducted preparations for a Joint Warfighter's Conference, to be held at the JWF JT, and a General Officer's Steering Committee (GOSC); and
- Prepared MOAs with organizations critical to program success.

JGPSCE will focus on the processes represented by the Joint Targeting Cycle to identify where the process could be interrupted through degradation or loss of GPS. The JT considers operations within combatant commands as the best opportunity to gain insight into GPS vulnerabilities.

JGPSCE is planning legacy products in three crucial areas: Operations, Intelligence, and Acquisition. Designation of legacy sponsors will be validated by the GOSC in spring 2000. Various legacy products affect the following:

- *Operations* legacy products affect the manner in which U.S. forces prepare

for and conduct war. The products apply to training, planning and actual operations.

- *Intelligence* legacy products affect the manner in which intelligence sources support the warfighters. Intelligence sources must be able to recognize threats to GPS users, make the commander cognizant of the threats, and characterize the threats as environmental, friendly, or hostile.
- *Acquisition* legacy products affects the manner in which GPS systems are developed, tested, and procured. These products will address system requirements, test methodologies for evaluating GPS vulnerabilities, and standards for GPS vulnerability testing. A Library of GPS Electronic Warfare Effects will offer up-to-date advice on GPS threats, vulnerabilities, test results and ways to guarantee GPS performance.

Additional information on JGPSCE is available in Appendix G or on the internet at http://www.jgpsce.jte.osd.mil.

The JT&E program also sponsors Joint Tests that develop new testing methodologies that have multi-Service applications and improve the use of Modeling and Simulation for testing as described in the next two programs.

1.2.8 The *Joint Advanced Distributed Simulation (JADS)* Joint Test benefits the warfighter by showing the T&E and acquisition communities how to link models, laboratories, simulators, and live test assets into a more robust test environment than what is traditionally available. The results are improved test processes with quicker, less expensive test and evaluation, and faster fielding of weapons, equipment, and TTPs.

The Defense Science Board concluded in a 1992 study that the Department of Defense should use Advanced Distributed Simulation (ADS) to link test ranges and facilities, training ranges, laboratories, and other simulation activities to improve testing and training. While ADS can create realistic, complex, synthetic environments for test and training purposes, T&E and acquisition professionals have been reluctant to use this untried technology. They have doubted whether ADS can deliver valid, T&E-quality data; the cost effectiveness of using ADS; and the advantages of using ADS in the T&E of various types of systems. To address these concerns, OSD chartered the JADS JT&E in October 1994 to develop and validate a testing methodology with broad multi-Service application by investigating the utility of ADS for T&E. JADS identified the critical constraints, concerns, and methodologies when using ADS and the standards that must be introduced into ADS systems if they are to support T&E. Now that JADS has completed all testing activities, its primary purpose has shifted from testing to providing legacy products and information to the T&E and acquisition communities, and providing assistance to testers struggling with the complex issues that JADS was able to overcome. The Air Force has been the lead Service.

In 1999, JADS completed its last two tests and initiated efforts to share the results and lessons learned with the appropriate organizations. JADS advertised and distributed its products, wrote test reports, presented papers at conferences, developed and distributed multimedia products, and started an extensive briefing trail to share test results and lessons learned with senior leaders throughout DoD who are involved in

T&E or acquisition. JADS did the following:

- Completed the *End-to-End (ETE) Tests, Phases 3 and 4* in March to assess ADS command, control, communications, computers, and intelligence, surveillance and reconnaissance (C4ISR) testing capabilities in an operational environment. The ETE Tests culminated in flights of an E-8C Joint Surveillance Target Attack Radar System (JSTARS) aircraft over Fort Hood, Texas, where ground-based light ground station module (LGSM) operators were able to observe live, virtual, and combined live/virtual areas of operation, and a virtual Army Tactical Missile System battalion was able to target and eliminate virtual ground targets during the test. The ETE Test team determined that ADS testing can be beneficial for test planning, rehearsal, and execution and can result in valid data being collected. They also identified critical constraints, concerns, and methodologies associated with using ADS for test and evaluation.
- Completed the *Electronic Warfare (EW) Test, Phase 3* in April to evaluate the utility of ADS to improve EW testing. The EW Test linked an F-16 aircraft with an ALQ-131 self-protection jammer at the Air Combat Environment Test and Evaluation Facility (ACETEF), Patuxent River Naval Air Station, Maryland with the Air Force Electronic Warfare Environment Simulator (AFEWES), Fort Worth, Texas, and the JADS Test Control and Analysis Center (TCAC), which served as the test control facility. The AFEWES simulated the threat environment using four hardware-in-the-loop simulators and interfaced with the TCAC and ACETEF through a high level architecture (HLA) federate. The TCAC provided the test control measures and the HLA federates published scripted aircraft time-space-position information, simulated threat activation times, and specific threat modes and codes.

As JADS nears completion in 2000, its legacy will cover a broad range of issues for the T&E community. JADS has defined its legacy program as "all actions JADS takes to ensure that its products are fully incorporated into the user community." There are three aspects to this effort:

- Educate the user community and instill ADS into its thought processes;
- Equip the user community with the proper ADS knowledge, procedures, and tools; and
- Institutionalize the products of the JADS JT&E for lasting value.

Additional information on JADS is available in Appendix H or on the Internet at http://www.jads.abq.com/.

Figure 1-7 The JADS End-to End Tests culminated in flights of an E-8C JSTARS.

1.2.9 The *Joint Electronic Combat Testing Using Simulation (JECSIM)* Joint Test benefits the warfighter by assessing whether the addition of modeling and simulation enhances the test and evaluation of electronic countermeasures.

JECSIM differs from JADS in that it focuses specifically on the testing of electronic combat systems by integrating multiple digital models in the Joint Modeling and Simulation System (JMASS).

There are major limitations in the current capability to evaluate the performance of Electronic Countermeasures (ECM). This includes a limited number of threat assets available for live fire testing, risk of losing personnel and high value assets during testing, and the high cost and restrictions associated with conducting a comprehensive open-air test program. There is a major emphasis on the test and evaluation community to make better use of simulation in acquisition programs from their inception. OSD chartered JECSIM in 1996, with the Navy as the lead Service and participation from the Army and Air Force to investigate the utility of digital models and simulations in the test and evaluation process of ECM devices against a semi-active surface-to-air missile, in order to determine if all-digital simulations enhance the robustness of the test process.

During 1999, JECSIM completed Ground Mounted Seeker (GMS) testing and the Captive Flight Test (CFT), and documented results from previous testing. In addition, JECSIM conducted simulation runs with JMASS 3.2M and JMASS 98 environments. These 1999 activities are summarized below.

- The GMS test provided seeker interaction with real targets, with and without ECM. Targets of interest included the B-1B with the ALE-50 towed decoy, and the F/A-18 with the AN/ALQ-165 ASPJ (Airborne Self-Protection Jammer).
- The CFT provided the most realistic clutter environment. Targets of interest included the B-1B and F/A-18.
- JECSIM completed the final reports for SA-6 live fire testing, laboratory testing, hardware-in-the-loop (HITL) testing, and radar cross section (RCS) testing.

JECSIM legacy products will include test and evaluation methodologies for using digital models to improve test definition. Other legacy products include a cost benefit analysis and a common database for verification, validation, and accreditation. Anticipated specific legacy products to be provided at program completion in 2000 include:

- *Supporting data* for M&S Verification and Validation (V&V), including extensive data on semi-active missile testing and Probability of Kill (Pk) generation to support M&S V&V;
- *Robust data set* that can be used to identify M&S deficiencies and needed improvements;
- *M&S roadmap guidance* into the need for refinement in physics-based modeling, M&S link requirements, configuration management, and V&V of individual models;
- *The JECSIM process*, established to demonstrate the capability of M&S to predict semi-active missile performance, thereby extending the utility of M&S in T&E; and
- *Assessment of M&S capability*: (1) the degree to which M&S can predict an actual missile engagement and (2) the sensitivity of Pk relative to endgame-related parameters.

Additional information on JECSIM is available in Appendix I or on the Internet at http://www.nawcwpns.navy.mil/~jecsim/.

1.3 Current Joint Feasibility Studies

OSD selected two nominations to conduct feasibility studies during the 1999-2000 cycle. These new studies were selected from a group of six. Currently, the new Joint Feasibility Study (JFS) teams are preparing documentation to determine if their proposed subject is *necessary* and *feasible* for a JT&E. This includes developing a Joint Feasibility Study Report and identifying and quantifying required test activities and resources. In the summer of 2000, the JFS teams will present their conclusions to the SAC for charter consideration. A brief description of each feasibility study follows.

1.3.1 The **Joint Battle Damage Assessment (JBDA)** feasibility study intends to improve Combat Assessment (CA) in joint operations with emphasis on Battle Damage Assessment (BDA) of mobile and fixed targets. As a result of operational and exercise experiences, joint force commanders acknowledge difficulty in obtaining effective and timely CA for engaging mobile and fixed targets. The key issues are the quality and availability of individual training for BDA analysts, procedures for BDA of mobile targets, interoperability of systems and architectures utilized in the CA process, and sensor availability for BDA requirements. JBDA will provide solutions to these issues which will, in turn, provide the warfighting commander with the timely and effective BDA that is needed for operational decision making. The Army is the lead Service.

1.3.2 The **Joint Command and Control (C2), Intelligence, Surveillance and Reconnaissance (JC2ISR)** feasibility study will investigate the Joint Task Force (JTF) and Component Commander's ability to employ intelligence, surveillance, and reconnaissance (ISR) sensors to detect, identify, track, engage, and assess fleeting, mobile surface targets. Prosecuting these high value targets requires precise synchronization of operations through rapid exchange of accurate information between ISR, C2, and weapon systems. JC21SR will quantify joint sensor tasking/re-tasking, cross-cue tipping, and associated information processing, exploitation, dissemination, and display (PEDD) deficiencies and provide analytical performance feedback to warfighters, the Services, Joint organizations, DoD agencies, and OSD. The resulting test and evaluation conclusions, recommendations, and legacy products will serve as a catalyst and roadmap for overall enhancements in C2ISR sensor management TTPs, operational concepts, and collection management training. The Air Force is the lead Service.

2.0 Joint Test and Evaluation Program Management

2.1 Program Management Structure

The Office of the Secretary of Defense (OSD) sponsors the JT&E Program to conduct tests and evaluations and provide information required by Congress, OSD, the Unified Commands, Services, and DoD components relative to joint operations. The JT&E Program is directed by Dr. George Schneiter, the Director, Strategic and Tactical Systems (D,S&TS), Office of the Undersecretary of Defense (Acquisition, Technology, and Logistics). The responsibility for management of the program is vested in Mr. Richard Lockhart, the Deputy Director, Developmental Test and Evaluation (DD,DT&E). As illustrated in Figure 2-1 Ms. Loretta Bloomer is the JT&E Program Manager. The JT&E Program Office has a site at http://www.jte.osd.mil/index.html on the Internet.

OSD management of the JT&E program includes involvement in all phases of the program, beginning with the nomination process through close out of a program. The office receives support from the Planning Committee (PC), Technical Advisory Board (TAB), and the Senior Advisory Council (SAC) as described in the following process section. OSD also provides funding and infrastructure support such as financial, property, contract, and security management. In addition, the JT&E Training Program assists participants throughout each phase of the program with classes for the nomination, feasibility, and test phases.

Oversight of test execution and technical support to the Test Directors is a priority throughout the year. In addition to regular TAB reviews, the JT&E Program Office, and DD,DT&E participate in numerous unscheduled reviews to assure that the tests are on-schedule, within budget, and meeting their objectives.

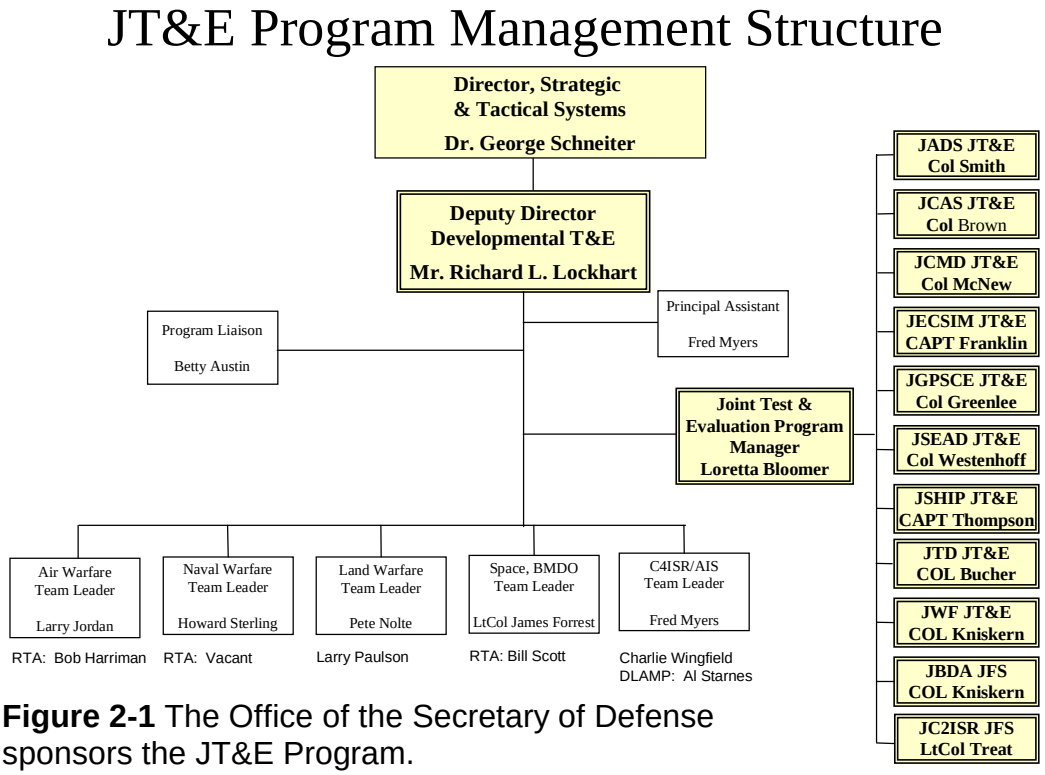

Figure 2-1 The Office of the Secretary of Defense sponsors the JT&E Program.

2.2 Process

As illustrated in Figure 2-2, the JT&E process involves three steps that result in providing products beneficial to the warfighter. The Combatant Commands, the Services, and DoD Agencies submit nominations for JT&E projects during the second quarter of the fiscal year for consideration by the SAC in June. The SAC is composed of senior (Flag and Senior Executive Service) leaders from the Office of the Secretary of Defense, the Joint Staff, JFCOM, the Services, and Defense Field Activities. A PC comprised of action officer representatives of the SAC, screens the nominations for technical and administrative sufficiency and forwards those nominations meeting established criteria to the SAC. The SAC prioritizes those nominations for the Director, Strategic and Tactical Systems, who then determines within funding constraints which nominations will be directed as a Joint Feasibility Study (JFS). Each JFS lasts approximately one year and assesses the *necessity* and *feasibility* of chartering a JT&E to address the issue of concern. In answering the *necessity* question, each JFS explores the support and need for the test with the Services, JCS, CINCs, and Department of Defense Field Activities. This culminates in the identification of a legacy customer for the proposed test. During the study, a TAB receives several briefings from the Joint Feasibility Study Director (FSD). The TAB is composed of senior test and evaluation scientists from OSD, the Services, and DoD Agencies. These briefings review the study's

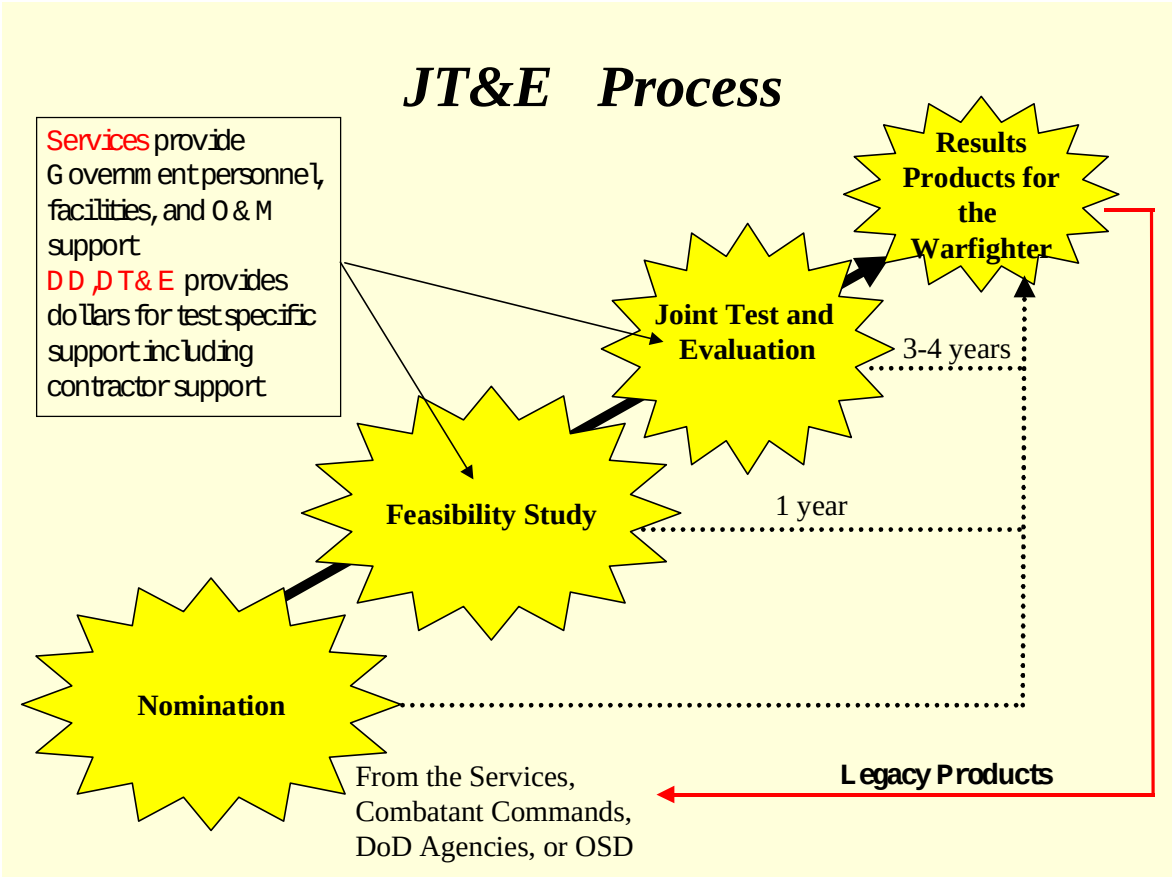

Figure 2-2 The JT&E Process emphasizes legacy products to customer organizations.

ability to address the following issues:

- Development of a concise problem statement;
- Scope of the test;
- Development of the test concept and scenarios;
- Development of an analysis methodology;
- Investigation of test venues; and
- Determination of resources required.

The results of the study are documented in a report called the Joint Feasibility Study Report, which is a plan of how to execute the proposed JT&E. Toward the end of the study year the TAB advises the SAC whether the JFS is technically feasible. The SAC then recommends whether the DS&TS should charter the JT&E.

Once chartered the JT normally takes three to four years. During this time, the Joint Test Director (JTD) takes the test full cycle from stand up to close out and dissemination of the final legacy products. The beginning years of the program are focused on resource and facility coordination along with the assignment of military personnel. Based on the Joint Feasibility Study Report, the JTD develops a Program Test Plan and a Data Management and Analysis Plan to describe how the test will be conducted. The execution phase of the test involves data collection, reduction, and analysis. The JTD disseminates interim test results and program status through the use of program reviews, Technical Advisory Groups, General Officer Steering Committee meetings, and interim test reports.

When the JT&E is completed, the JTD briefs the SAC, the Services, and operational customers on the results of the JT&E and its legacy products. Legacy products are then transitioned to designated customers before test closeout. These legacy products include Joint Publications, multi-Service tactics, techniques, and procedures manuals, and technical reports as well as a database of all field test data.

2.3 Resources

OSD provides approximately $40M per year for all JT&E programs to fund for program administration and costs that are unique to the JT or JFS. This includes test execution, travel, and dedicated contractor support, as well as training and website support.

In addition to funding, JT&E resources include JT&E handbooks that describe the administration of the program. They also provide a description of the nomination process, the JFS analysis process, and JT&E execution. DoD Directive 5010.41 is the governing policy document that describes the JT&E process, identifies the principal participants and their responsibilities, and outlines the framework from which each Service supports the program. In addition, a JT&E library is maintained and cataloged, so that all reports and data collected are institutionalized for future reference.

The lead Service provides funding for facilities, assigned and supporting civilian personnel, and administrative and routine logistical support. The lead Service also provides the JTD, a Deputy Director, the majority of military personnel, administrative support, and assistance in personnel administration, comptroller activities, supply, and logistics. Participating Services provide Deputy Directors and additional military personnel.

2.4 Management Initiatives

In addition to the JTs' accomplishments, the DD,DT&E and the JT&E Program Office continuously strive to improve the quality of the administration of the JT&E program to ensure cost effective program management along with relevancy to war-

fighter requirements. DD,DT&E initiatives are intended to improve the JT&E program, promote the program, and proactively justify JT&E funding. The initiatives include program promotion, improving nominations, increasing customer involvement, producing results sooner, improving TAB functioning, and defining reasonable scope during the planning process. These initiatives are summarized below:

- **Promoting the JT&E Program**. The future viability of JT&E program is dependent upon new nominations to maintain activity in the JT&E pipeline. Worthy nominations must address problems facing the warfighters to be relevant but these will not be forthcoming if the capabilities of the program are not well known. Because JT&E uses the testing discipline to apply rigor to the analysis, there is a tendency to focus on the test community in publicity. Warfighters and testers are JT&E customers, and the JT&E message needs to reach both. This initiative delineates methods and procedures to promote program awareness within this customer community.
- **Improving Nominations**. Nominations are the foundation of the JT&E program. This initiative encourages every member of the JT&E organization to participate in the generation of nominations and puts an emphasis on members of the JT&E program participating in the defense community to solicit and mentor the development of new nominations.
- **Producing Results Earlier**. Many senior-level decision-makers have concerns that it takes too long to get products from the Joint Tests in the hands of the customers. This initiative provides guidance to the Joint Feasibility Study (JFS) Directors and Joint Test Directors on early and interim products.
- **Improving Customer Involvement**. Customer identification and involvement during the Joint Feasibility Study (JFS) and the JT is crucial to a successful JT. Customers should be the source of legacy product definition. The success of the JT is judged by the quality of the legacy products. This initiative makes provisions for early identification of legacy product customers and delineates a process for active customer participation during all phases of the test.
- **TAB Functions and Participation**. The JT&E Technical Advisory Board is an important body to the success of the Program. These technical experts ensure that each test tackles these very complex, joint issues using a methodology that is technically feasible. It is important that the Program make efficient use of this valuable resource. This initiative provides guidance to the JFS Directors and JTDs on the procedures to be followed in preparing and presenting briefings to the TAB.
- **Defining a Reasonable Scope for a Joint Test**. The DD,DT&E goal is to increase emphasis on defining a reasonable scope for future JTs. This must be accomplished in the feasibility study. However, maintaining a reasonable scope must receive continual emphasis during the Joint Test. There are continuous pressures during the conduct of a JT to increase the scope. These pressures come from various sources to include TAB members, GOSC members, Services, and others.

This initiative ensures that future training will emphasize that tests must guard against input that increases scope and strive to maintain focus in order to obtain the objectives of the JT charter.

Joint Test and Evaluation Program
1999 Annual Report

Appendices

Joint Suppression of Enemy Air Defenses (JSEAD)

Warfighting commanders require a capability to conduct effective joint suppression of enemy air defenses (JSEAD). Since the Gulf War, JSEAD strategy has emphasized destructive, preemptive targeting to destroy an enemy's integrated air defense system (IADS). As enemy IADS and surface-to-air missile threats become more technologically sophisticated and more mobile, it is increasingly difficult to target them preemptively, making an effective, reactive JSEAD capability a continuing requirement. At the same time, the U.S. military drawdown has reduced the dedicated assets (such as the F-4G Wild Weasel and the EF-111 Raven) formerly available to perform reactive JSEAD.

Problem Statement

Regardless of conflict intensity, the JFC currently conducts either area of responsibility/joint operations area (AOR/JOA) or localized JSEAD operations as a subset of offensive counter-air. AOR/JOA-level operations break apart an enemy's IADS by targeting key command and control (C2) and air defense positions. In most cases, however, AOR/JOA-level operations cannot completely eliminate enemy IADS capabilities. Pockets of integrated air defense components remain and continue to pose a threat to U.S. air operations. These pockets can be avoided, suppressed, or destroyed for specific time periods through localized JSEAD.

Localized JSEAD operations apply both preplanned (preemptive) and opportune (reactive) targeting. The current strategy preemptively targets key enemy IADS assets via the Air Tasking Order (ATO). Reactive targeting is conducted in conjunction with the ATO to protect U.S. and Allied forces. Within preemptive and reactive JSEAD, commanders employ both destructive and disruptive force application methods. Destructive forces seek out and destroy IADS elements while disruptive forces attempt to temporarily deny, degrade, deceive, delay, or neutralize IADS elements. Within the context of the U.S. military drawdown and the increasing sophistication of the mobile surface-to-air missile threats, the Services have recognized a need *to improve the JFC's near-term ability to conduct reactive JSEAD utilizing existing Service assets*.

Feasibility and Necessity

On 8 June 1995, the Senior Advisory Council (SAC) recommended JSEAD as first priority for an Office of the Secretary of Defense-sponsored Joint Feasibility Study (JFS). As a result, the Deputy Director, Systems Assessment/Test, Systems Engineering and Evaluation (now Deputy Director, Developmental Test and Evaluation) directed that a Joint Feasibility Study be conducted from July 1995 to September 1996 to determine the feasibility and necessity of a Joint Test and Evaluation (JT&E) to resolve JSEAD issues. At the conclusion of the study, the JFS team recommended chartering a full-scale JT&E program to focus on *near-term improvements to the end-to-end reactive, localized JSEAD targeting process*.

Purpose and Charter

In September 1996, the Director, Test, Systems Engineering and Evaluation chartered the JSEAD Joint Test (JT) to conduct a JT&E with emphasis on improving the end-

to-end reactive JSEAD targeting process. The JT was directed to characterize the reactive (localized) JSEAD targeting process, baseline current capabilities, quantify element contributions to that process, identify deficiencies, and test and evaluate potential improvements. Two key areas emerged as the most likely to have a near-term impact on the overall end-to-end reactive, localized JSEAD targeting process: (1) the potential contribution of an enhanced intelligence, surveillance, and reconnaissance (ISR) architecture and (2) the potential improvements offered by better information use and targeting processes within the Joint Air Operations Center (JAOC). The established JSEAD JT issue is: *Do end-to-end JSEAD targeting process enhancements improve reactive, localized JSEAD effectiveness?* Three separate test issues address specific parts of the program issue:

- **Test Issue 1:** "Do the proposed changes to ISR collection improve reactive JSEAD effectiveness over the current baseline?"
- **Test Issue 2:** "Do the proposed changes to intelligence processing improve reactive JSEAD effectiveness over the current baseline?"
- **Test Issue 3:** "Do the proposed changes to command and control (C2) improve reactive JSEAD effectiveness over the current baseline?"

Program Organization

The JSEAD JT established its headquarters facility in October 1996 at Nellis AFB, Nevada. The Air Force is the lead Service, and the Army and Navy are the participating Services. A total of 22 U.S. military and government civilian personnel were authorized. Contractor personnel made up the remainder of the JSEAD JT staff. Total FY98 JT manning was 41 government and contractor personnel. Additionally, two contract positions were established at Fort Walton Beach, Florida, to provide on-site coordination with the USAF Battlestaff Training School and with BLUE FLAG exercise personnel. FY99 JT manning stands at 51 government and contractor personnel.

Test Approach

The JSEAD test accomplishes its charter by collecting data in conjunction with Joint and Service training exercises, developing enhancements to the reactive SEAD targeting and ISR processes, and testing these enhancements in realistic exercise environments.

Background

Program Test Plan (PTP) *(September 1997)*

The JSEAD JT presented the initial PTP draft to the General Officer Steering Committee (GOSC) for review and comment on 9 July 1997. GOSC comments were incorporated into a final edition of the PTP which was approved in September 1997.

Test Activities *(November 1997- Dec 1998)*

Data Management Exercise (DME). JSEAD accomplished a DME during BLUE FLAG 98-1, at Hurlburt Field, Florida, from 13 - 21 November 1997 to test data collection, management, and analytic techniques. JSEAD JT personnel conducted this test on a minimal-interference basis with the ongoing BLUE FLAG exercise.

Computer-Assisted Exercise (CAX 98). JSEAD conducted Computer-Assisted Exercise 98 at Hurlburt Field, Florida, from 1–8 March 1998 to answer Test Issue 2. The trials characterized the information and decision-making processes in the Joint Air Operations Center (JAOC) and quantified improvements in those C2 processes in relation to the end-to-end reactive JSEAD targeting process.

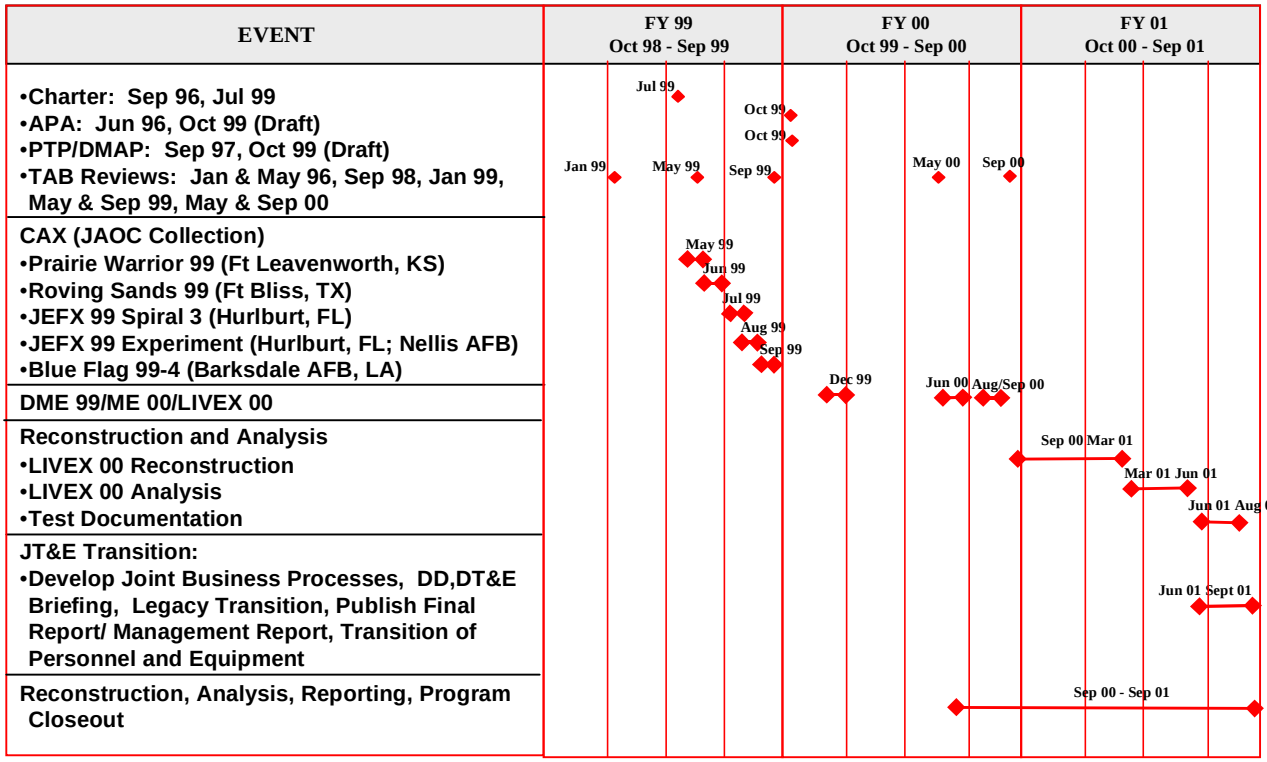

Figure A-1 JSEAD Program Schedule

Live-Fly Exercise (LIVEX). LIVEX 98 was conducted as part of the multi-Service GREEN FLAG 98-2, from 18 April - 2 May 1998, at Nellis AFB, Nevada, to answer Test Issue 1. LIVEX 98 trials characterized the end-to-end JSEAD process and quantified the performance and improvements to that process and in the ISR architecture. Multi-Service participation, including U.S. Army Battlefield Coordination Detachment and intelligence aircraft, U.S. Navy SEAD, strike and intelligence aircraft, U.S. Air Force strike and intelligence aircraft, and national intelligence sensors were integrated into the test to provide a true cross-discipline, cross-platform intelligence architecture and a joint force test of JSEAD concepts.

Test Analysis and Results. Post CAX 98 and LIVEX 98 activities included extensive trial reconstruction and analysis. Before these activities started, the JSEAD staff loaded the database, created various tools, and built and verified the ground truth tables.

CAX 98 and LIVEX 98 reconstruction and analysis have been completed. The results, which addressed the first four charter elements, were published in an Interim Report and are available in a classified briefing. Test results did not confirm that the employed process enhancements made a statistically significant difference in the program level measures of effectiveness; however, numerous operational improvements were observed in both JAOC and ISR areas. Through the ongoing operational analysis,

these key areas have been refined and are the focus of continuing research and analysis. The analysis highlighted ISR areas along with lessons learned. Suggested improvements have been incorporated into the LIVEX 00 plan.

1999 Accomplishments

Activities Scheduled for 1999

The JSEAD plan for 1999 contained a full schedule of data collection and analysis activities leading to a program completion in 2000. CAX 99, which had been reconfigured due to the CENTAF/9 AF Commander's cancellation of the preceding Blue Flag exercise, and LIVEX 99 would provide sufficient field data for rigorous analysis of enhancements to the JAOC and ISR processes. However, LIVEX 99, scheduled for 10 - 24 April 1999 in conjunction with the GREEN FLAG exercise at Nellis AFB, was canceled at the last minute due to operational requirements. This cancellation resulted in the need to reassess JSEAD program-level plans and schedules, as well as the overall priority of the JSEAD JT&E.

Program Reassessment

Following the cancellation of the LIVEX 99 test event, the SAC reviewed JSEAD's progress and proposed extension, and rated it as the top priority JT&E. The SAC recommended an eighteen-month extension in order to conduct an additional LIVEX in August/September 2000 and complete program-level analysis and reporting requirements. JSEAD made the necessary revisions to its PTP and Data Management and Analysis Plan to reflect this 18-month extension. After the TAB expressed concern about the risk associated with the execution of LIVEX 2000 in less than a year, the JT scheduled a data management exercise for late 1999 to rehearse end-to-end data collection and analysis methodologies.

Completed Activities

Computer-Assisted Exercise (CAX 99). The JT collected data on the reactive JSEAD process in the air operations centers associated with four major exercises: Prairie Warrior 99, Roving Sands 99, Joint Expeditionary Force Experiment (JEFX) 99, and Blue Flag 99-4. Information collected from these venues will be compared to that gathered during CAX 98. While the enhancements cannot be separately and rigorously tested in these exercises, comparisons of several different approaches to the reactive JSEAD process are possible.

Prairie Warrior 99 provided the first opportunity to observe reactive JSEAD functions as executed in the new Air Operations Center (AOC) Facility at Hurlburt Field, Florida.

While Roving Sands 99 proved to be of limited value, JEFX 99 provided a first look at the USAF Battle Control Center (BCC) concept along with an opportunity to observe several new initiatives specifically designed to enhance the prosecution of Time-Critical-Targets (TCTs) and reactive JSEAD targets.

The Blue Flag 99-4 exercise, conducted jointly by 8AF and 12AF, provided a second look at reactive JSEAD functions in a consolidated AOC similar to CAX 98. All four venues provided information that helped: 1) characterize the reactive JSEAD process within the AOC; and 2) compare and contrast a variety of approaches to the reactive JSEAD problem.

Data Management Exercise 99 (DME 99). JSEAD conducted DME 99 in conjunction with the USAF Weapons School Mission Employment (ME) exercise from 29 November - 8 December 1999 at Nellis AFB, Nevada. The purpose was to mitigate risk in LIVEX 00 by rehearsing the end-to-end data collection and analysis methodologies for Simulated IADS, ISR, and Combat

Operations in a live-fly environment similar to LIVEX 00.

Planned Activities

Test Activities

ME 00. A second ME rehearsal is planned in June 2000 at Nellis AFB that will focus on the command, control, and communications architecture that will be implemented in LIVEX 00.

LIVEX 00. Live-Fly Exercise 2000 (LIVEX 2000) is planned for 26 August - 9 Sep 2000, in conjunction with the GREEN FLAG 00-4 exercise at Nellis AFB, Nevada. LIVEX 00 will test and evaluate potential improvements to the reactive JSEAD process through the implementation of candidate solutions within the ISR, intelligence processing, and C2 processes. Four baseline trials and eight enhanced trials will be conducted during the two-week period.

Reconstruction, Analysis, and Closedown.

In June 1999, the program's charter was extended until Sep 2001. Following LIVEX 00 in August/September 2000, test reconstruction and analysis efforts will be accomplished. Concurrently, test reports will be written, legacy products completed, and results disseminated.

Legacy Products

Completed Products

During 1999, the JSEAD JT provided several timely products to our warfighters, including Operation Allied Force during the early stages of operations over Kosovo and Operation Northern Watch over Iraq. Additionally, JSEAD provided deficiency reports about data corruption and problems in threat training equipment to system owners.

In the course of planning and executing two large test activities in 1998, the JSEAD JT identified several deficiencies, some of which had solutions that could immediately executed or reported to those agencies having authority to implement solutions.

The first such legacy product concerns the identification of data corruption from various sources of intelligence. This corruption was a function of the established intelligence networks and not isolated to the test articles used by the JSEAD JT&E. These sources have been reported to the commanders of the unified and specified commands for further study and ultimate correction.

The second product is a fix to the Tactical Intelligence Broadcast System (TIBS). The JT team noted a corrupt program-processing unit at the Aerospace Integration Center (AIA) (previously known as the Space Training Facility) at Nellis AFB. The team provided HQ AIA System Management Office (SMO) a letter identifying TIBS corruption.

JSEAD provided two products about deficiencies in threat systems, one concerning hardware and the other concerning software. The hardware deficiencies involved a simple on-off switch on a threat system. While the system's computer tracked whether or not commands to radiate power were issued by the computer, it had no knowledge of whether or not the manual switch was thrown that would actually send power to the transmitter. Identification of this situation ensured erroneous data was excluded from test results. It also led to revised data collection plans for future test activities. Additionally, the JT identified software deficiencies. The data in certain threat systems showed counter-intuitive results. After investigation, the JSEAD JT identified a field in the data with a "reverse result." A report to the system's owner was quickly sent, and the problem was verified and fixed, preventing any further erroneous data.

The JSEAD JT also evaluated ISR, C2, and IADS attack operations for the Commanding General, Operation Northern

Watch in February 1999. The JSEAD team's analysis established the specific capabilities and limitations of mission resources available to the Combined Task Force and recommended ways to improve operational effectiveness. These results, in turn, were briefed to USEUCOM J-3. While Operation Northern Watch did not receive the resources required to implement the solution recommended by the JSEAD JT, its new understanding of ISR and C2 challenges led it to develop a novel JSEAD targeting solution. This solution enabled it to effectively pursue U.S. national objectives despite increasingly sophisticated countermeasures.

JSEAD's final completed product is the *JSEAD JT&E Interim Report*. This report describes deficiencies uncovered in the 1998 tests, particularly in the key result areas of completeness, accuracy, and timeliness. This report forms much of the basis for further investigations that will produce more JSEAD JT products in the coming months. Contents of this report in an earlier draft form were provided to key planners of Operation Allied Force during the early stages of that operation.

In Progress Products

A number of JSEAD JT products are still in development. These legacy products meet the *Joint Vision 2010* requirement to produce value-added changes to Doctrine, Organizations, Training, Materiel, Leader development, and People (DOTMLP).

Doctrine. There are several doctrine-related products. First is a draft multi-Service manual of tactics, techniques, and procedures concerning reactive JSEAD. The Air Land Sea Application Center (ALSA) located at Langley AFB, Virginia is the customer for this product projected for delivery in March 2001.

Another doctrine product recommends changes to tactics contained in the Air Force's AFTTP 3-1 series manuals. This product is planned for delivery to Air Combat Command (USAF) in July 2001. Similar document changes will be provided each Service with publications addressing JSEAD.

The Joint Staff J-7 is the customer for several products. These include specific changes to joint doctrine manuals including JP 3-01.4 (JSEAD), JP 3-56.1 (Command and Control for Joint Air Operations), and JP 3-60 (Joint Doctrine for Targeting). The entire joint publication series will be studied for potential changes. All these products are projected to be delivered to J-7 in August 2001.

Organizations. The JSEAD JT will recommend key organizational changes. One set of recommendations will be provided to CINCJFCOM concerning the organization of joint task forces and their prosecution of the JSEAD mission. This product is projected for delivery in August 2001.

The CINCs and Services will get results-based observations that have the potential to influence organizational decisions at several levels, including individual platform mission and weapon assignments, C2ISR force management, shooter force management, and mission sequencing. If test results indicate significant changes to mobilization, force flow, or disposition of forces, these results will be reported to CINC J-5s and J-3s.

The Services will also be given suggested changes to their organizations. Some of these will be specific to the structure of the joint air operations center. Others will address collection management for intelligence, surveillance, and reconnaissance and their organizational alignment in combat situations. These products are all scheduled for delivery in July 2001.

Training. The JSEAD JT will produce training plans for several important functions. One is targeted on members of an intelligence fusion cell in a JAOC. Another addresses the training of an operations rep-

resentative who is projected to increase the timeliness of JSEAD targeting. Finally, there will be a training plan for members of the JAOC regarding the use of successful enhancements evaluated in the JSEAD JT. Target date for all products is August 2001.

Materiel. While not testing technologies directly, the JSEAD JT expects to report on several technologies participating in the live-fly test of September 2000. These reports will be delivered to the acquisition representatives of the Services and to USJFCOM as soon as completed, but no later than July 2001. Further, test data will directly establish the C2ISR supportability of specific weapons and platforms which in turn supports better modeling and more accurate analysis. Additionally, the JSEAD JT, will produce individual recommendations concerning further investigation of each candidate enhancement showing promise, including those considered for inclusion in the JSEAD JT but rejected for a cause unrelated to their promise. This series of products (one for each enhancement or enhancement candidate) will be provided to the applicable Service and to JFCOM no later than August 2001.

A significant product will be the master database of information collected from all the test events. This database, along with detailed methods suggesting ways to extract various data elements, will be delivered to OSD and to USJFCOM in August 2001.

Leader Development. A key product for leader development is a JSEAD courseware module for insertion in the joint flag officer course currently taught at Hurlburt Field, Florida for candidate Joint Force Air Component Commanders. This product will address the challenges of reactive JSEAD and recommend alternatives for senior leader actions. It is scheduled for delivery in July 2001.

Another product in this category is a Commander's Guide for JSEAD Campaign Planning. This document will be provided to the Services and to USJFCOM in August 2001.

People. The JSEAD JT will produce a human factors report describing a variety of ways to improve the human element involved in prosecuting the reactive JSEAD mission. This report will be delivered to the Services and to JFCOM in August 2001.

Summary

In summary, the JSEAD JT, like all joint tests and evaluations, is chartered to "address and evaluate solutions to problems or deficiencies in joint operations." To be effective, these solutions must be institutionalized. The JSEAD JT recognizes this imperative and has a number of products already produced and many more in work with specific customers in mind and established target dates.

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Joint Close Air Support (JCAS)

Perhaps the mission requiring the greatest amount of integration between ground and air elements is Close Air Support (CAS). This is primarily due to the proximity of friendly troops to the effects of fire support. Prior to Desert Storm, the Services had been fielding systems to increase night combat capability. Desert Storm served as a "proving ground" for the rapid pace and 24-hour capability of modern technology in today's warfare. One of the highlighted problems from this more robust combat capability was the potential for the increase of fratricide levels, particularly in night or low visibility situations. The supporting tactics, techniques, and procedures (TTPs) contained in the 1995 document, *Joint Publication 3-09.3 (Joint Tactics, Techniques, And Procedures For Close Air Support)* have lagged significantly to be able to execute Joint Close Air Support (JCAS) for today's technology.

Problem Statement

A joint working group met in October 1996 and validated the following problem statement:

> *There has been no significant effort to evaluate the effectiveness of Joint Night CAS operations.*

Feasibility and Necessity

The Office of the Secretary of Defense (OSD) directed the Joint Night Close Air Support (JNCAS) Joint Feasibility Study (JFS) in July 1996 to study the joint night CAS issue. The joint working group of 70 representatives from the four Services and joint agencies supported the problem statement and provided insight on shortfalls. The Feasibility Study Director (FSD) provided briefings to the Services, the warfighting Commanders-in-Chief (CINCs), operational units, and Service training agencies to gain the opinions of a wide array of subject matter experts on night CAS capabilities and requirements. The following commanders provided strong support for the chartering of a Joint Test and Evaluation (JT&E):

- Commander, USAF Air Warfare Center;
- Commander, USA National Training Center;
- Commanding Officer, Naval Strike & Air Warfare Center; and,
- Commanding General, Marine Corps Air Ground Combat Center.

The FSD conducted extensive research and study of Service and joint TTPs for employing joint night CAS, and also conducted a search for pertinent test data on the subject.

Purpose and Charter

The purpose of the JCAS JT&E is to provide the warfighter with an evaluation of the baseline effectiveness of conducting joint CAS and to examine the potential for improvement in the areas of TTPs, systems capabilities, and training. The baseline effectiveness of conducting joint CAS will inform the CINCs of their current capability. The study of potential improvements will provide the Services and the Joint Staff with a validated database from which to make informed decisions on future training and joint TTPs.

OSD chartered the JNCAS Joint Test (JT) organization as a JT&E on August 14, 1997 to employ multi-Service equipment and personnel to investigate, evaluate, and improve the operational effectiveness of joint U.S. forces conducting night CAS. The charter was amended July 8, 1998, to in-

clude day CAS operations and a subsequent name change to Joint Close Air Support. The JCAS project will evaluate the current conduct of day *and* night CAS to determine the mission effectiveness of U.S. forces in a realistic joint military operations environment, identifying and verifying potential mission area enhancements.

Program Organization

The Air Force-led JT is located at Eglin Air Force Base, FL, to take advantage of the Air Force testing facilities located there. The Joint Requirements Oversight Council-sponsored All Service Combat Identification Evaluation Team (ASCIET) is also located at Eglin and has a wealth of information on joint testing that could help this JT. Coordination for testing locations and concepts has occurred with:

- National Training Center, Fort Irwin, CA;
- Air Warfare Center, Nellis AFB, NV;
- Marine Corps Air Ground Combat Center, Twenty-Nine Palms, CA; and,
- Naval Strike and Air Warfare Center, NAS Fallon, NV.

The primary testing activities will take place at the National Training Center (NTC), Fort Irwin, CA, and U.S. Air Force Air Warrior, Nellis Air Force Base, NV. Supporting data, sorties, and concepts will be utilized from the Marine Corps Air Ground Combat Center, Twenty-Nine Palms, CA, and the Naval Strike & Air Warfare Center, NAS Fallon, NV.

Test Approach

The JCAS test accomplishes its charter by collecting data in conjunction with Joint and Service training exercises, developing enhancements to CAS process, and testing the enhancements in realistic exercise environments.

Background

The JCAS JT became a fully operational JT&E 1 October 1998, and executed the first mini-test in November 1998. Field tests began March 1, 1999. Testing will continue through September 2002.

The JT established the JCAS JT site at Eglin AFB, FL. The JFS site was expanded with space, furniture, and equipment to sup-

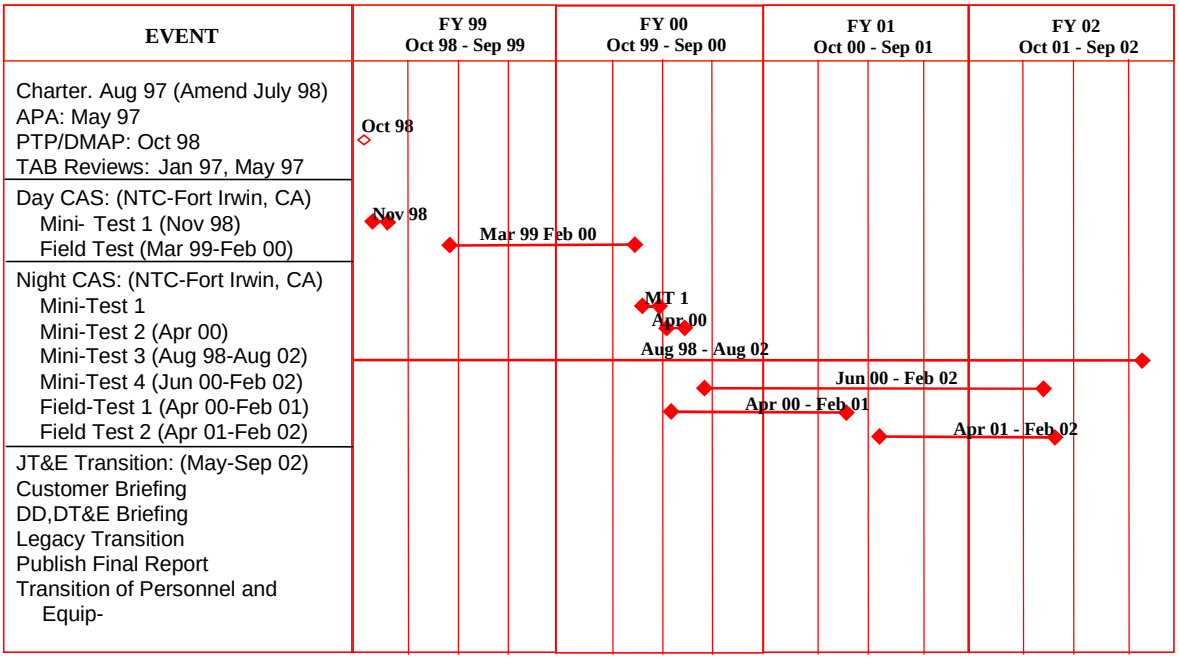

Figure B-1 JCAS Program Schedule

port the 22 military, 5 government civilian, and 21 contractor personnel that compose the JT. The team has established two other locations for test support, the first at Nellis AFB, NV, and the second at Ft Irwin, CA.

The team has signed memoranda of agreement with the U.S. Army NTC at Fort Irwin, CA, the 57th Wing, Nellis AFB, NV; the 99th Range Group, Nellis AFB, NV; the 15th Air Base Wing, Hickam AFB, HI; and the ASCIET, Eglin AFB, FL. These agreements describe in detail the responsibilities of the JT staff, NTC staff, Air Warrior staff, and 25th ASOS personnel in supporting the JT at the NTC and Air Warrior without impacting the training that the Army and Air Force units receive.

Developed Program Test Plan. The Program Test Plan is the road map for the execution of the JCAS JT. It describes the individual tests in detail and includes a Data Management and Analysis Plan, which ensures that the issues can be answered with the data gathered at each test.

Conducted Day CAS Mini-Test 1. This mini-test was conducted in November 1998. It measured the Forward Air Controllers' (FACs') ability to positively control CAS aircraft at medium altitude in daytime operations. Multiple aircraft passes were flown under controlled conditions to determine if the forward air controllers could accurately assess which target the CAS aircraft were attacking.

1999 Accomplishments

This year the team collected data from Field Test 1 at the NTC and at the U.S. Air Force's Air Warrior, Nellis AFB, NV. This field test will establish the baseline capability of U.S. forces to conduct the Joint CAS mission. The test's initial focus was during the first two "force on force" battles where the highly trained 11th Armored Cavalry Regiment (ACR), as the Opposing Force (OPFOR), provides the most realistic operational environment possible. Following the "force on force" phase, the focus will transition to the first two "live fire" battles. "Live fire" battles have notional threats and allows for live weapon fire to be utilized to mark potential CAS targets.

The JCAS JT delivered presentations to the NATO Air Ground Operations School Commandants from ten European locations at RAF Leeming, UK and to the AIRCENT CAS Conference at Ramstein AB, GE. Several nations, led primarily by the Netherlands and Great Britain, have expressed keen interest in participating in a similar effort in Europe.

Planned Activities

Timeline. The current timeline has the JT ending September 30, 2002. The JT will be comprised of large-scale tactical field testing, smaller-scale non-tactical mini testing, and subsequent analysis of the data. The JT&E will then be completed with final reporting, coordinating recommendations and briefings to the CINCs, Services, and Joint and OSD agencies.

Field Tests. Three large-scale field tests are executed at the NTC during normal training rotations for Army units. Air Warrior, at Nellis AFB, NV, supports this training with CAS sorties. Each field test takes nine months due to the limited number of CAS sorties per training rotation. The 11th ACR (the OPFOR) will be the unit used for JCAS test excursions. Each blue force rotational training unit arriving at the NTC will also be studied during their exercise.

The JT is using the first field test to establish the baseline effectiveness of Joint day CAS and then compare excursions in control procedures. The second field test will establish night CAS baseline effectiveness and then compare excursions in control procedures. The third will study excursions in night systems and TTPs. Approximately one half of the JCAS staff (25 personnel at

Eglin AFB, FL; 2 personnel at Nellis AFB, NV; and 3 personnel at NTC, Fort Irwin, CA) will participate during each of the nine rotations that will make up a field test. The remaining personnel will continue to analyze previously acquired data.

Mini-Tests. The JCAS JT will conduct four more mini-tests at NTC to provide a controlled environment for studying specific areas of night CAS operations. Each mini-test will take three to four days. (Day CAS Mini-Test 1 was conducted in November 1998.) Night CAS Mini-Test 1 will use the same procedures as Day CAS Mini-Test 1 except in darkness and with ground detection data included.

Night CAS Mini-Test 2 will measure the ability of FACs and CAS aircrews to effectively use infrared pointers in single pointer and multiple pointer environments. Multiple aircraft passes will be flown while the forward air controllers attempt to mark targets with their infrared pointer. An Army maneuver platoon will also be employing their pointers in close proximity.

Night CAS Mini-Test 3 will study the merits of various precision-guided munitions on CAS effectiveness. Multiple aircraft passes will be flown using various precision-guided munitions technologies. The accuracy and timeliness of target designation and engagement will be studied.

Night CAS Mini-Test 4 will study the effects of various designation devices under live-fire situations. Infrared pointers, flares, and laser target designators are just three of many devices used to designate targets for CAS aircrews. This test will measure their accuracy and timeliness under actual weapons employment. This test will be accomplished during each training rotation used for field tests.

Legacy Products

The JCAS JT will conclude the five-year test with a final report of recommendations and briefings to all affected and interested agencies within the Department of Defense. The JT also offers several unique legacy products.

- ***Range instrumentation system improvements***. The JT identified significant time delays from the actual movement of instrumented vehicles/personnel to when they were actually displayed on screens. The JT identified buffering problems that precluded accurate Battle Damage Assessment (BDA) on a real-time basis. JCAS then made improvements to allow for real-time BDA.
- ***Fielding of low cost data collection capability***. The JT has developed a low cost, off-the-shelf capability to rapidly collect data in the field and transmit data elements from geographically separated collectors to the main data base support facility at Eglin AFB, FL. Department of the Navy and Department of the Air Force organizations have opted to develop similar programs for carrier qualification training and the Air Force Test Pilot School.
- ***Development of improved Joint CAS mission checklists***. The JCAS JT has developed mission checklists for the tactical operations center, terminal attack controllers, and aviation mission areas that comprehensively cover the planning, preparation, and execution phases of Joint CAS.

- ***Successful demonstration of ability to conduct simultaneous testing and training***. The JCAS JT successfully demonstrated testing in a large scale training venue. Conducting testing and training at a location such as the NTC allows for multiple collection opportunities over a period of time and avoids reliance on a single test event.
- ***Baseline effectiveness data***. The JCAS JT will leave behind a large database of the current capability. This validated information will be readily available for the development of new doctrine, new TTPs, support for acquisition programs, and to give CINCs a better understanding of current combat capability.
- ***Improved understanding of the CAS process***. The JT will focus on the CAS process for five years. This will provide valuable insight on many portions of this process, particularly on how well the joint portion works. The Joint CAS mission area has already enjoyed increased awareness at the flag level for all services.
- ***Exercise and test enhancements***. Instrumentation has improved tremendously, but instrumentation systems are not always as compatible as they should be. The NTC and Air Warrior systems each provide valuable data to participants but are separate systems. The JCAS JT has demonstrated the ability to merge these systems' data for display on a single executable program for the rotational training unit as a takeaway product from their activities at the NTC.
- ***Joint training recommendations***. Studying and evaluating the current joint CAS process will highlight shortfalls in current joint training.

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Joint Warfighters (JWF)

The prosecution of time-sensitive targets has often been cited as deficient, highlighted by two examples from the Persian Gulf War:

- On 26–27 February 1991, a large portion of the Republican Guard Forces Command (RGFC) was allowed to escape across the Euphrates River. The RGFC escaped because of confusion and a breakdown in coordination.
- The first Army Tactical Missile System (ATACMS) ever fired in combat was delayed for hours while appropriate clearance was coordinated by all of the various nodes. While procedures were refined during the course of the war, it was not unusual for subsequent firings to be delayed up to two hours for clearance.

Difficulty in prosecuting Time-Sensitive Surface Targets (TSSTs) appears to be a common problem. Parochial Service interests in the joint application of firepower can be traced to World War II and are still being debated. This is reflected in the "Roles and Missions" debate among the Services over proposed joint doctrinal publications that address the command and control of firepower. The JWF Joint Test (JT) does not seek to enter this roles and missions debate. However, the critical nature of engaging TSSTs must be resolved and can be addressed outside the roles and missions debate.

Problem Statement

"Targeting must be improved." (Department of Defense [DoD] Final Report to Congress, *Conduct of the Persian Gulf War*, 1992).

Intensive examination of problems in employing joint firepower, specifically for time-sensitive targets, revealed difficulties in timely and effective coordination, deconfliction, and synchronization, which increased execution timelines and caused the recurring need to create operational workarounds.

A JFS Joint Working Group (JWG) recommended limiting the JWF problem statement to targets that are considered critical, unplanned, and engaged rapidly. Thus, the term "time-sensitive targets" was selected. The group also recommended restricting the problem statement to "surface" targets, excluding airborne and subsurface targets, such as submarines. Therefore, the problem's scope is limited to TSSTs as shown in the problem statement:

> *Joint military operations and exercises have revealed difficulties in effectively and efficiently prosecuting time-sensitive surface targets in an area of responsibility and/or joint operating area.*

The group identified the *find*, *locate*, *identify*, *plan*, *task*, and *strike* functions as pertinent to timely target attack. Further discussion of these functions produced 44 questions for analysis, grouped into four categories: *doctrine*, *organization*, *process*, and *technology/equipment.* Subsequent analysis of the functions, categories, and questions surfaced by the working group revealed that each could be addressed under four issues relating to four phases of the joint targeting cycle (Figure C-1).

While progress has been made in precision/accuracy, standoff/depth, mission-munitions fit, and desired effects, the area of timeliness has not improved. In some aspects, it has even declined.

The two examples cited in the introduction best illustrate the facets of the targeting problems that JWF will address:

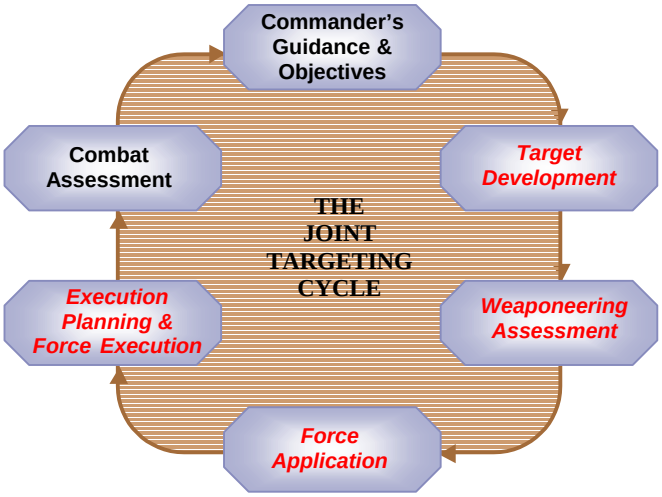

Figure C-1 The Joint Targeting Cycle

coordination, procedural, equipment, and interoperability problems, in addition to problems that surface when a new weapon system or other capability is introduced without examining its impact on coordination and procedures.

This latter problem is illustrated in Figure C-2.

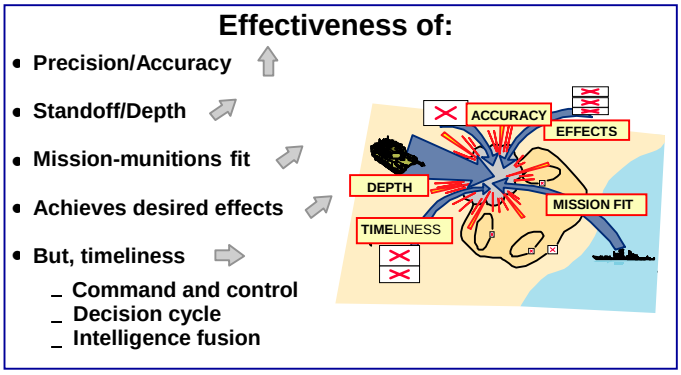

Figure C-2 Trends in Firepower

The examples illustrate poor procedures in the prosecution of TSSTs that can result in complex and serious repercussions. The RGFC was given the opportunity to regroup and put down a U.S.-inspired rebellion, to assist Saddam Hussein in consolidating his power, and most recently, to deploy and become actively involved in the Kurdish faction fighting in Northern Iraq. The significance of the missed opportunity to prosecute this "time-sensitive target" is evident in the frustration of two U.S. Presidents and the expenditure of vast resources.

In the Department of Defense Interim Report to Congress, *Conduct of the Persian Gulf War,* the transmission of targeting information was cited as a shortcoming for being "slow and cumbersome because of inadequate interoperability. This increased workloads, lengthened transmission time, and reduced the potential flexibility and responsiveness of Coalition forces." The same report cites:

> *"Much of the aggregate combat power achieved by the highly integrated military campaign was facilitated by 'work arounds' that bridged disparate Service planning procedures and cross-connected specialized intelligence and tactical data systems…Evaluation of these lessons and the continued development of a comprehensive foundation of advanced joint doctrine will continue to be high priority objectives."*

However, no joint doctrine has been published to address the TSST issue to date.

The Department of Defense stated, in *Conduct of the Persian Gulf War, Final Report to Congress, 1992*, that "the theater Commander in Chief has the key role in theater-level targeting, but this role is not clearly defined in joint doctrine. This lack of definition caused confusion and duplication…." Another issue involved the problems encountered attempting to locate and destroy TSSTs. The finding for the issue: "…targeting must be improved."

The last five to six years have not seen much improvement in the JFC's ability to prosecute TSSTs. *The Participant Guide – Phase I* for Unified Endeavor 97-1 under the subject of "Joint Fires" states:

"Regardless of the issues and differing views, the Joint Force Commander, his staff, and components always make it work, albeit

with varying degrees of success. At what expense?"

JWF will assess the capability of systems and procedures that are in development to resolve interoperability problems of a JFC to prosecute TSSTs effectively and efficiently.

Feasibility and Necessity

The Office of the Secretary of Defense (OSD) Deputy Director, Test and Evaluation (DD,DT&E) directed the Joint Warfighters (JWF) Joint Feasibility Study (JFS) in June 1995 with the Army as the lead Service. Initial JFS efforts focused on tactical fire coordination and joint fire support at the operational level of war. The effort became embroiled in contentious doctrine and roles and missions issues. As a result, the Senior Advisory Council (SAC) refused to charter the JWF JT, but instead extended the JFS and directed specific changes to focus on the original JT&E nomination issues.

The Army responded quickly to the SAC's guidance, moving the JFS sponsorship to the Training and Doctrine Command (TRADOC) and replacing the original JFS staff. The new Feasibility Study Director (FSD) immediately directed his staff to research targeting deficiencies. The JWF JFS presented a series of briefings to the Joint Staff, the combatant commands, the Services, and the Test and Evaluation (T&E) agencies, from the level of action officer through director and, in some cases, Commander-in-Chief (CINC). These briefings obtained guidance and support and reassured all parties that the JWF effort was back on track.

The JFS team conducted a thorough characterization of the targeting process through research, polling of Subject Matter Experts (SMEs) from all of the Services, the Joint Staff, and the unified commands, and the efforts of a JWG. After compiling inputs and reviewing the JWF characterizations, the JWG adopted an entirely new problem statement that would become the basis for the JWF JT approach.

This JWG, composed of 32 SMEs and Service doctrine developers in the grades of O-4 to O-6, was hosted by the Air Land Sea Application (ALSA) Center, Langley AFB, Virginia, in October 1996. The JWG developed a consensus that there are irrefutable problems in employing joint firepower, specifically for time-sensitive targets.

In the year preceding charter, JWF completed the JFS determining the necessity of the JT&E. As specified in OSD's *Joint Feasibility Study Handbook*, one criterion is to determine whether the problem is significant enough to warrant the expenditure of resources. Research indicated that the problem is worthy of a JT&E.

Purpose and Charter

OSD approved the JWF JT charter on August 14, 1997 to*:*

"Employ multi-Service and other Department of Defense (DoD) agency support, personnel, and equipment to investigate, evaluate, and improve the operational effectiveness of joint operations against TSSTs. JWF will establish a baseline case by evaluating and documenting current time-sensitive target processes and procedures in realistic operational scenarios. Potential deficiencies and opportunities for improvement will be identified and verified. Potential improvements will be identified, installed, and tested in environments as closely aligned with baseline measurements as possible. Analysis of the collected data will be used to evaluate their effectiveness and suitability. The outcome of these evaluations will be used to determine the validity of these beneficial hypotheses."

Program Organization

The JT is fully manned with authorized Army, Air Force, government civilian, and contractor personnel. The Navy is providing one Deputy and the Marines are not represented. The Director has moved to make up the expertise shortfall through contractor hirings.

JWF was unable to remain a tenant in the Joint Warfighting Center Joint Training, Analysis, and Simulation Center (JTASC). The Army Corps of Engineers arranged for the test force to acquire a leased building next to the JTASC for its new headquarters. JWF began operations at this location in late April 1999.

Test Approach

The JWF JT schedule is shown in Figure C-3 and will be conducted in the following six phases:

Organization. This phase encompasses those actions necessary to "stand up" the JT following the chartering decision and includes establishing offices, obtaining personnel and equipment, etc. This phase is complete.

Spinup. As this phase is initiated, preparations will be made to observe a Joint Force Command (JFC) exercise in its entirety. The objective for this phase is to develop and refine test plans and procedures, practice data collection, and exercise data transmittal. These plans and procedures are further refined and/or validated during a second JFC exercise.

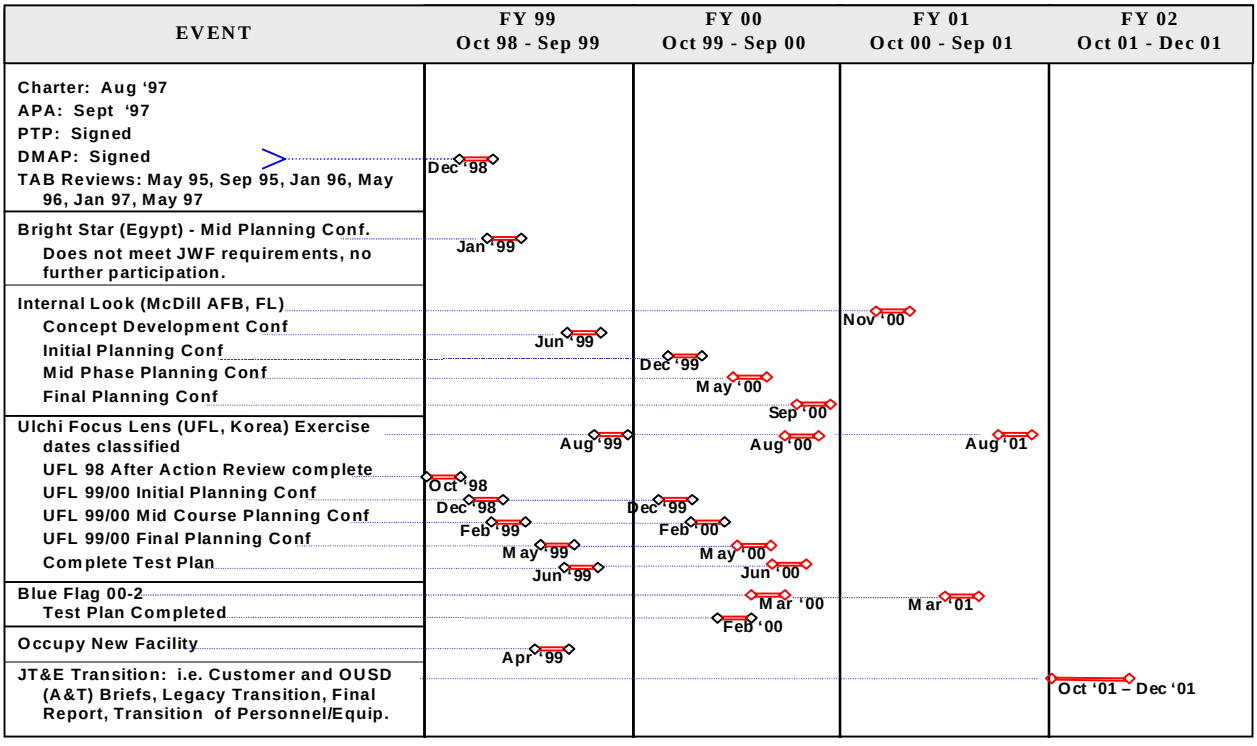

Figure C-3 JWF Program Schedule

Testing of Current Processes. This phase consists of testing and data collection of the current processes and technology for prosecuting TSSTs to build a baseline for evaluating improvements. This test phase includes at least two regional exercises: one Computer-Aided Exercise (CAX) and one Live Exercise (LIVEX).

Note: The focus is specifically concentrated on information gathering during the baseline effort and will avoid debate on doctrinal issues during this phase. JWF is including provisions for an intermediate phase to coordinate with the CINCs and Services prior to exploring any JWF-induced doctrinal alternatives to joint training exercises, if the baseline data indicates the need.

Testing of Enhanced Processes. In this phase, the JT Team examines proposed enhancements to prosecuting TSSTs, again, during two or more regional exercises, one CAX and one LIVEX.

Analysis and Assessment. After the conclusion of the test activities, the JT analyzes the data to establish baseline performance and assess the effects of the tested enhancements on combat effectiveness. These assessments determine the value of each tested enhancement. Periodically, findings and lessons learned are disseminated through Service channels and to the DTSE&E in the form of "interim reports."

Reporting and Close Down. The JT prepares the final JT briefings and final report, transitions the legacy products, and closes out the JT.

Background

In the preceding reporting period, JWF continued to organize the JT. Between September 1997 and March 1998, JWF grew from the original group of eight to 68 personnel. Organizing also includes obtaining adequate facilities and equipment. JWF learned late in the year that a new home would be required and began the search for a suitable location. Concurrent with the facility and personnel ramp-up, the JWF staff planned for future activities. Extensive planning was conducted in preparation for participation in Internal Look 98 and Blue Flag 99-2. Both exercises were subsequently canceled due to operational tempo.

Great effort went toward solidifying the understanding of our value to the warfighter. Support from these commanders is crucial. JWF will participate in their exercises, assist in planning for their exercises, establish TSSTs as exercise objectives, insert test articles, and collect data during their exercises. If they did not believe the JWF product would help them fight, they certainly would not agree to allow JWF participation in these exercises. It is interesting to note that these senior warfighters are unanimously in support of JWF. The following are signed, written quotes from selected commands.

Examination of tactics, techniques, and procedures used by joint force commanders to attack time-sensitive surface targets is critical to the development of appropriate joint Doctrine….

DCINC USCENTCOM

The observations and recommendations that come from this JT&E will contribute to the enhancement of US PACOMs joint [TSST targeting] procedures

DCINC USPACOM

We believe the proposed JWF Joint Test and Evaluation Time-Sensitive Surface Targets (TSST) study could benefit joint task forces in our theater.

DCINC USEUCOM

I support the continued development of the JWF concept… and encourage [in-

corporation of] other efforts into the overarching JWF effort.

CG USFK

Joint Warfighters Joint Test and Evaluation is one of considerable interest to the Marine Corps and the Combat Development Command. Therefore, I endorse …this program.

DCG MCCDC

I fully agree that the program is a worthwhile and much needed effort. The Commander and Staff of U.S. Marine Corps Forces, Atlantic, fully support your request for our involvement.

DCG II MEF

I share your desire to refine the process of prosecuting Time-Sensitive Surface Targets (TSSTs). The process of prosecuting TSSTs is certainly worthy of Examination.

CG USCENTAF

Armed with this endorsement from the senior warfighters, JWF sought to refine essential relationships with their subordinate staffs and other agencies. As shown in Figure C-4 this effort was successful.

1999 Accomplishments

During 1999, JWF published its Program Test Plan (PTP) and Data Management & Analysis Plan (DMAP), after approval by DD, DT&E and DOT&E. Even though Blue Flag 99 was canceled, a final draft test plan was completed and lessons learned from that process were applied to the UFL 99 Test Plan. The JWF Legacy Team has been established and is working to ensure that the warfighter customer does not have to wait to benefit from the value-added products. To further prepare for data collection at joint exercises, Operation CIGAR (C4I Gathering and Requirements) has been implemented to research the models and simulations used at the various joint exercises. Also, the use of Integration Definitions (IDEF) has been implemented to analyze the targeting process. To help convey the status and results of the JT, JWF has published three issues of its

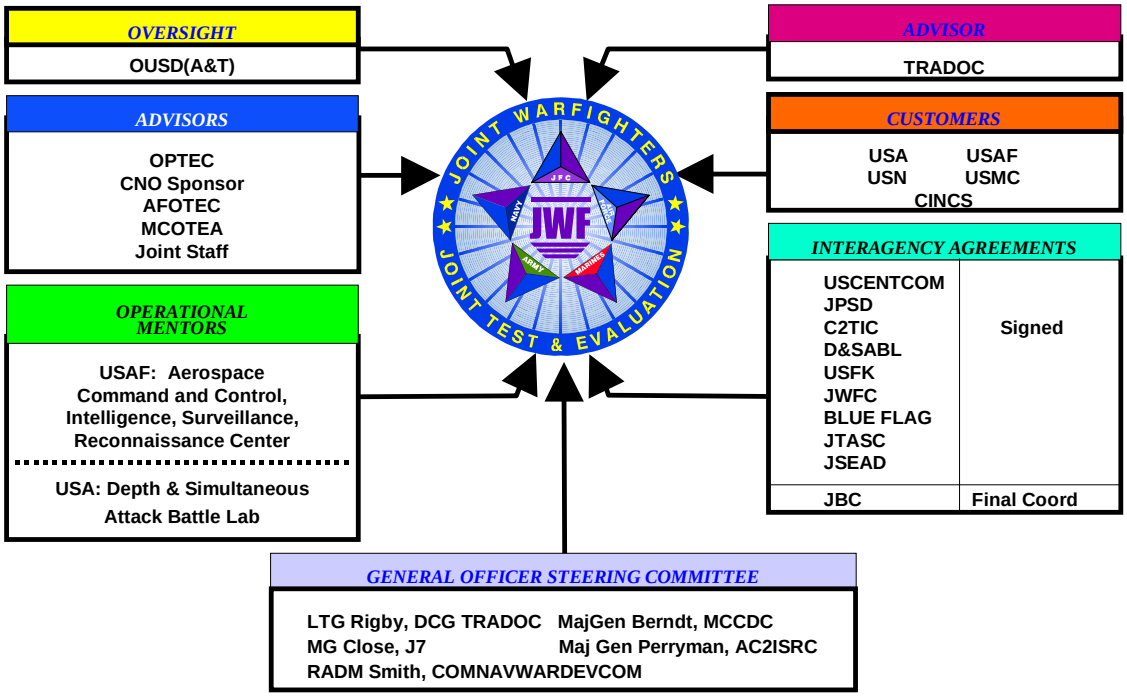

Figure C-4 JWF Organizational relationships

newsletter *Warfighting Times* (October 98, March 99, September 99). The next issue will be published in March of 2000 after data collection at Blue Flag 00-2.

JWF participated in the 25th Ulchi Focus Lens (UFL 99) Command Post Exercise in the Republic of Korea in August to baseline the targeting process. The main body of JWF returned Sunday, August 29 from a successful data collection mission. Fifty-eight test team members deployed to Osan Air Base, CP Tango, Camp Humphries, Red Cloud, Yongin, Pohang, and the USS Blue Ridge to stand side-by-side with the U.S. and ROK players and gamers to collect data on the joint prosecution of TSSTs. This was the largest JT&E OCONUS deployment ever. Two 12-hour shifts covered the exercise non-stop in order to ensure all TSSTs were either collected or at least accounted for. Manual data collectors closely monitored the players and gamers while the automated data collectors tapped into 18 UFL systems to ensure nothing crucial was missed. The JWF Command Post on Osan Air Base ran an extensive 24-hour data management center that kept the collectors supplied with media and tools to do their job. Couriers carried data packages back and forth from the command post to teams positioned outside of Osan. Personnel, data, and equipment all made it back to Suffolk safely. The analysis and reconstruction of the substantial data collected at UFL will begin while preparations for participation in Blue Flag, Internal Look, and UFL 00 are finalized.

In addition to preparing for and collecting data during UFL 99, JWF completed many other tasks. The *TSST Monograph, Workarounds During Desert Storm*, was published in the proceedings of the Joint Warfighting conference at the Royal United Services Institute, London. JWF also returned from observations at last year's UFL to complete a Deep Operations Coordination Cell report. The USFK CJ3, MG Lennox, used this report to revise procedures for the DOCC. The JWF team observed that nearly all JWF recommendations had been implemented during this year's UFL. MG Lennox sent a letter to DDSA/DTSE&E in appreciation for JWF assistance.

JWF participated in two *Joint Publication 3-60 (Joint Doctrine for Targeting)* Working Groups and has now been designated a technical review authority for the publication. Members participated as observers for JFCOM during Theater Missile Defense Initiative at three different locations. The test plan for UFL was completed in July. JWF submitted an article covering their experience at UFL to the ALSA Bulletin to be published this December.

JWF also established a World Wide Web site during the last fiscal year, and continues to update it. The site address is http://www.jwf.jte.osd.mil.

Planned Activities

Testing of Current Processes. This ongoing phase will continue during 2000 and consists of testing and data collection of the current processes and technology for prosecuting TSSTs to build a baseline for evaluating improvements. Testing will be conducted with USCENTAF (9AF) in conjunction with their Blue Flag exercise and with USCENTCOM during exercise Internal Look.

Testing of Enhanced Processes. Enhancement testing will be conducted during 2000. The shortcomings in joint targeting, particularly the prosecution of TSSTs, are widely recognized, and several organizations have addressed the issue. As a result, many improvements in the areas of doctrine, TTPs, and equipment have been proposed. Doctrine development has advanced in narrow areas (e.g., the development of Joint Publication 3-01.5, *Doctrine for TMD*) and several equipment improvements have been

evaluated and incorporated at the component level. However, the Joint Surveillance Targeting and Attack Radar System (JSTARS) transmits one picture to the ground element and another to the air element that are not identical. The All Source Analysis System (ASAS) experiences the same shortfall, providing the land/amphibious component commander a picture different from the one provided to the air component commander. In today's warfighting, where each component has the capability to locate and attack time-sensitive targets (possibly simultaneously) in a mutual battlespace, *the prosecution of the full range of TSSTs by a joint force in a realistic environment* has not been addressed by any program other than JWF. The JWF JT will allow the opportunity for testing enhancements/test articles – those proposed by other organizations as well as by JWF – in the right environment.

The selection of test articles is based on the problems to be solved. The basic problem is stated in the JWF problem statement and is summarized as "current joint force command and control systems do not allow unified, real-time coordination and deconfliction of all forces" in the ALSA multi-Service pamphlet, *Targeting – The Joint Targeting Process and Procedures for Targeting Time-Critical Targets*. Many procedural enhancements in the form of TTPs are proposed in the ALSA pamphlet. Where applicable, those proposed enhancements will be used as test articles that provide ALSA with the opportunity to test their TTPs. ALSA has long had the lead in attempts to improve the prosecution of TSSTs. They will continue to be used as SMEs in the JT planning and execution.

JWF will coordinate the actual enhancements with the warfighters who conduct the exercises. Some of the enhancements under consideration include:

- Joint application of the Advanced Field Artillery Tactical Data System (AFATDS) as a coordination and deconfliction aid. The current AFATDS, used by the Army and Marine Corps, is being modified to interface with the ATO and to provide situational awareness information for all joint force attack operations;
- Joint application of the Automated Deep Operations Coordination System. This LAN system, currently in Army field tests, was developed to provide targeting operation coordination and deconfliction capabilities. It has interface capability with ASAS and other situational awareness tools such as AFATDS;
- Improvements to TTP addressing the coordination and the impacts on the components of restrictive and permissive measures such as boundaries; Fire Support Coordination Measures (Free Fire Areas , Coordinated Fire Lines , Fire Support Coordination Lines , No-Fire Areas , Restricted Fire Lines/Restricted Fire Areas ; Airspace Control Areas ; and, Airspace Control Measures (Restricted Operations Areas/Restricted Operations Zones, High Density Airspace Control Zones , Minimum Risk Routes , And Special Use Airspace);
- Evaluation of any new doctrinal guidance on the employment of firepower as it pertains to TSSTs;
- Detailed TTPs for the employment, coordination, and use of common reference systems such as grid boxes;
- A system of ensuring automatic doctrinal, TTPs, CONOPS, etc., modifications when a new (to the theater or AOR) weapon system or capability is introduced;
- Doctrine for restructuring and streamlining the joint force and component structures to enhance timeliness in prosecuting TSSTs;
- Introduction of the Army's Deep Operations Coordination Cell (DOCC). The

DOCC is a C2 node that plans, coordinates, and manages deep operations. The DOCC selects attack assets, including those to be employed by other component commanders;

- Introduction of the Combat Integration Capability (CIC) system. The CIC, now in development, is designed to consolidate relevant sensor, intelligence, and ATO information at the Control and Reporting Center (CRC) or JAOC/AOC. The CIC features connectivity to the Battlefield Coordination Detachment (BCD), DOCC, and Force Protection Tactical Operations Center (TOC), thus providing a means to coordinate and deconflict TSST attacks;
- Introduction of interoperability (interconnectivity) efforts currently in development for existing communications equipment to permit communications between the BCD and JAOC and among the Army TOCs, the Marine Combat Operation Centers, and the Air Force CRCs;
- Establishing, artificially, if necessary, standardized locations for common and dissimilar C^2 terminals. This would facilitate TTPs and doctrine development as well as potentially improve joint force coordination;and,Establishing a common target number (CTN) system. CTNs currently exist for only fixed installations and enemy order of battle (EOB).

The program structure for enhancement testing is similar to that for establishing the baseline. The personnel requirements remain the same – 68 total military, civilian, and contractor.

JWF's contribution to the warfighter's return on investment will be significant and direct. The joint procedural problems that currently exist and have been documented for years regarding timeliness of fires will be reduced, if not eliminated. Procedures will improve since there are no standard TTPs now. Any procedures produced will not only improve interoperability and combat effectiveness but will also reduce fratricide. Much of the delay in the prosecution of TSSTs is caused by the inability to rapidly coordinate attack locations versus friendly positions.

In summary, the JWF approach will be to document and assess baseline efficiency for each exercise, apply enhancements, and evaluate the joint force targeting process for improvements and the reasons for the improvements. Enhancements selected during the JT to improve the combat effectiveness and efficiency of prosecuting TSSTs may include new or modified doctrine and TTPs, processes, organization, systems, equipment, and training.

Analysis and Assessment. After the conclusion of the test activities, the JT will analyze the data to establish baseline performance and assess the effects of the tested enhancements on combat effectiveness. JWF is currently in this phase for UFL. These assessments will determine the value of each tested enhancement. Periodically, findings and lessons learned will be disseminated through Service channels and to the DD,DT&E in the form of "interim reports."

Reporting and Close Down. The JT will prepare the final JT briefings and final report, transition the JT's legacy products, and close out the JT.

Legacy Products

A legacy product provides a basis to implement the conclusions and recommendations of the JT when it is completed. Potential users of the legacy products include the Joint Staff, combatant commands, the Services, and other JT&E efforts.

Documentation of Operational Concepts and Tactics, Techniques, and Procedures (TTPs). The documentation of the TSST process baselines will be of explicit value. There is near total agreement that

documentation is a potential problem in our warfighting abilities. One hypothesis of JWF is that shortfalls in performance are related to the shortfalls in documentation. In addition to providing the comparative foundation for enhancement testing, the documentation and promulgation of the TSST processes will allow commanders an opportunity for objective scrutiny and provide trainers with the building blocks for tomorrow's curriculum. JWF will prepare a compendium of data that supports JT findings and outcomes concerning the operational concepts and TTP to effectively prosecute TSSTs. The documentation will address problem areas and will recommend changes to enhance combat effectiveness. The users of this data will be the Joint Staff, combatant command staffs, the Service staffs, and the commanders and staffs of operational units. This data may also serve as a benchmark baseline of targeting transactions to support future improvement efforts.

Validation of and Input to Newly Approved Joint Doctrine and TTPs. The JT will recommend changes to specific joint publications that should be made. JWF could produce requirements for a completely new publication. The JT team will prepare and change recommendations and provide them to the Joint Staff, Services, and agencies as needed.

Recommendations for Joint Training. The JT team will identify potential enhancements to the training of individuals and JTF staffs as well as component commands/Service staffs in prosecuting TSSTs. As a result of the test activities, the team will gain expertise in the methods and processes needed to enhance joint operational training. Recommendations may concern proficiency standards, changes in the mix and echelons of units, assessment and feedback methods, and training methods involving live, constructive, and virtual simulations. Joint schools, as well as Service training schools, may receive recommendations on how to enhance their curriculum. These recommendations can also be incorporated into joint- and Service-hosted battle manager exercises to train battlestaffs on how to coordinate the efforts of multiple components.

Recommendations for System Requirements. JWF results will be the basis for providing recommendations to the Joint Staff and the Services for developing or modifying systems to enhance the effectiveness of prosecuting TSSTs. It is anticipated that the JT team will identify problems in areas such as the interoperability of communications/data systems and the commonality and effectiveness of tactical situation displays. The JT team will prepare inputs that document such problems and recommendations on correcting them.

Recommendations for JFC Organization. There are no joint doctrines that describe how a joint force should be organized for the command and execution of fires. JWF expects to document the various organizational structures currently in use along with the positive attributes and problem areas associated with each example.

Modification to the Universal Joint Task List (UJTL CJCSM 3500.04). JWF will provide input to the UJTL which currently contains no operational or tactical tasks for targeting TSSTs. As described earlier, the criticality of time-sensitive surface targeting warrants specific tasks in the premier joint training task list.

Additions to JCS-Approved Joint Definitions. JWF will develop new and revised joint terminology definitions for incorporation into Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*. These definitions will improve the joint lexicon by clarifying the current terminology and defining new terms to better describe a JFC's responsibilities when conducting time-sensitive surface targeting.

Development of a Desert Storm Monograph. As a product of research into the lessons learned from Operation Desert Storm, the JWF team published a monograph discussing the most notable wartime problems encountered in the joint environment when prosecuting TSSTs. These examples of the challenges incurred in conducting real-time targeting and the joint application of firepower will provide the Services with a relevant exemplar that can be used as an established point of departure in the training of battle managers.

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Joint Theater Distribution (JTD)

To accomplish their diverse missions, Commanders-in-Chief (CINCs) must have a joint theater distribution (JTD) system with the means to control the flow of materiel through the in-theater logistics pipeline. To make this JTD system a reality, the business processes at the distribution nodes within the in-theater distribution pipeline need to be reengineered. This will lead to an effective and efficient JTD system that allows CINCs to achieve their objectives.

Problem Statement

Recent military and humanitarian operations have highlighted the difficulty of managing the in-theater physical distribution of assets (forces and sustainment), the related information flows, and the integrated management processes necessary for the CINC to execute directive logistics authority to provide the "right support to the right customer at the right time, the first time."

Feasibility and Necessity

The Office of the Secretary of Defense (OSD) directed a Joint Feasibility Study (JFS) to be conducted from September 1997 through September 1998. This JFS demonstrated the necessity and feasibility of conducting a Joint Test and Evaluation (JT&E), as documented in the Analysis Plan for Assessment (APA).

The OSD Senior Advisory Council (SAC) reviewed the results of the JFS and recommended that the JTD Joint Test (JT) be chartered.

Purpose and Charter

The purpose of the JTD JT is to enhance theater distribution effectiveness and efficiency and provide a means to better control the in-theater distribution pipeline to achieve the CINCs' objectives. JTD JT focus is on business process redesign, substantiated by rigorous testing, of the physical and management processes and the information flows as they relate to in-theater distribution activities. In doing this, the JTD JT addresses the ability of CINCs to effectively and efficiently conduct JTD in their geographical Area Of Responsibility (AOR) or joint operating area.

OSD chartered JTD on 2 September 1998 to employ multi-Service and other Department of Defense (DoD) agency support, personnel, and equipment to measure quantitatively and qualitatively the effectiveness and efficiency of the DoD in-theater distribution system. The JT will then enhance theater distribution through the application of improved business practices.

Program Organization

The JTD JT established its headquarters at Ft Lee, VA in October 1998. The Army is the lead Service, with the Air Force, Navy, and Marine Corps as participating Services. All Service personnel are now assigned. Due to shortfalls in the availability of programmed Service personnel, JTD has requested an increase in the level of effort for support contractor personnel. Three of these positions are geographically located in PACOM, EUCOM, and CENTCOM with CINCs where JTD will conduct field testing.

Test Approach

JTD accomplishes its charter by conducting a test using a team of Service and contractor personnel. Data will be collected on the physical processes, information flows, and management processes and procedures that occur within the Aerial Ports of Debarkation, Seaports of Debarkation, Hub/Advanced Logistics Site distribution locations, Trailer Transfer Points, Terminal Transfer Units and the Customers. The inefficiencies of in-theater distribution will be identified by input from the nodal subject matter experts, cause and effect analysis, and modeling. The results of these analytical efforts will provide the test articles that will be consolidated into treatments and tested in subsequent data collection and verification efforts within each identified CINC's AOR.

At the request of these CINCs, field testing will be conducted during normal day-to-day activity at the nodes. Their premise is that if personnel train and operate in peace as they will in contingencies, there will be a near-seamless transition as the volume in the distribution pipeline increases. Hence, the CINC can meet operations tempo (OPTEMPO) increases by providing the resources necessary to allow the nodes to reach their maximum capacity, using the best business processes. Additionally, if an OPTEMPO increase occurs during testing, data will also be collected to document its effect, if any, on the nodal processes.

While this JT will focus on in-theater distribution sustainment operations, it also will examine end-to-end distribution pipe-

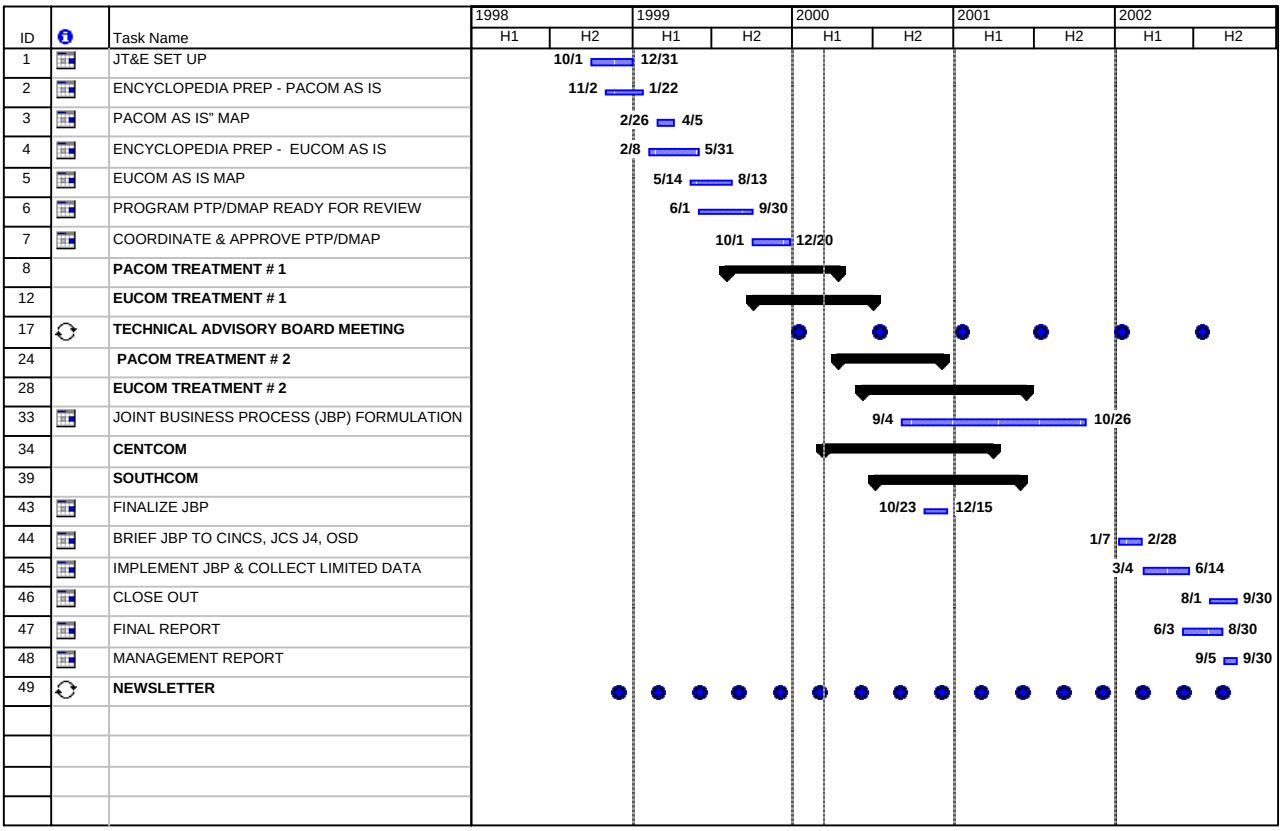

Figure D-1 JTD Program Schedule

line operations if it is shown during the test that a problem has its origin outside the in-theater distribution pipeline. The objective is to improve the CINCs' ability to execute their directive logistics authority, thus providing the right support to the right customer, at the right time, the first time.

The JT, in coordination with the Office of the Assistant Secretary of Defense (Command, Control, Communication & Intel), will also consider information assurance during all aspects of the JT to include data collection, process mapping, recommended improvements, and treatment phases.

The test will begin in PACOM, then cover EUCOM and CENTCOM. JTD will provide periodic reports to the Joint Staff, with a final report due in September of 2002. This sequence of effort was established as a result of scheduled pipeline activity and JCS J4 recommendations.

Background

Due to delays in the assignment of Service and contract personnel, the JTD JT will now run from September 1998 to September 2002. Since being chartered, the JTD JT has since achieved the necessary manning and equipment required to conduct of the JT and prepare program planning documents.

1999 Accomplishments

Initial Distribution Business Process Mapping

JTD conducted initial mapping of the PACOM and EUCOM in-theater distribution nodes from March through August 1999. This mapping was necessary to baseline the current business process and measures of effectiveness.

Program Test Plan (PTP)

JTD delivered the initial draft of its PTP to the JT&E Program Office on 30 September 1999. A meeting was held at the JT&E Program Office on 26 October 1999 to discuss revisions to the JTD PTP to reflect the evolving JT&E Handbook and lessons-learned from the 29 September 1999 approved JSHIP PTP.

JTD revised the PTP and resubmitted it to the JT&E Program Office on 10 December 1999. The program office made additional comments, and JTD delivered an amended PTP to the JT&E Program Office on 11 February 2000. PTP approval is anticipated in March 2000.

Pre-Test Activities.

Detailed site plans were written for PACOM, with test activities planned to begin in the March 2000. A January 2000 meeting with the PACOM/J4 and his staff is finalizing the test articles and locations.

Interim Products

JTD developed the "Distribution Manager's Operational Architecture," also called the "Distribution Manager's Cockpit," and provided it to PACOM (including U.S. Forces, Korea) during initial business process mapping activities. PACOM has already incorporated this innovation into the PACOM CINC 21 project.

Planned Activities

The detailed site plans will be written for EUCOM, and test activities are planned to begin in the April 2000 timeframe. In addition, once the PTP is approved, the mapping of the "As Is" process in CENTCOM will need to be accomplished, with selection of test articles and testing to follow.

During 2000, the JTD plans to finish the first round of testing in both the PACOM and EUCOM AORs, with the possibility of mapping the CENTCOM unique business processes.

Legacy Products

The Deputy Joint Test Director will have proponency for the production of legacy products. A Legacy Plan will be developed and will describe the JTD JT products, their implementation, how they will be institutionalized, and the transition of those products to the customer for proper custodial care. The JTD General Officer Steering Committee will be used to determine the direction the product development should take, and will facilitate in the institutionalization of the legacy products.

There are currently five types of legacy products envisioned for the JTD.

Improved Business Processes. Based on iterative analysis and testing, the joint business process will be formulated from the best-of-the-best distribution business processes. These processes will be designed to be effective, efficient, and agile. Once the joint business processes for each node type have been developed, the processes will be modeled and extended to the geographical CINCs for inclusion in their AORs.

SIMPROCESS Model. There are several modeling initiatives with potential for legacy products. The first is a business process redesign model that is capable of aggregating and analyzing the data collected, relative to the issues within the JT. This software and the resultant nodal distribution models would then be left behind, allowing the CINCs to continue to enhance the distribution business processes of their in-theater pipeline and develop business processes to support potential pipelines for contingencies. Both CINCPAC and CINCEUR have expressed an initial interest in procuring the software tool and obtaining the models that will be in final form at the end of the JT. These models will have the latest versions of the best business processes for each node type evaluated within each CINCs AOR. During the CINCs out-briefings for the "As Is" mapping, members of the CINC J4 staff commented on other projects where the SIMPROCESS software tool could provide utility. This is a value-added product of the JT.

The second modeling legacy product would utilize the results of the model to define or refine the values assigned to nodal activities in the existing suite of Joint Simulation compliant DoD requirements based models (e.g. Joint Flow & Analysis System for Transportation, Enhanced Logistics In-theater Support Transportation, etc.). This product will establish the requirement for the upgrade of joint planning models to accept nodal refinement input. DoD systems builders may have to modify existing programs to accept and process this nodal information. This process is extremely important to wartime model efficiency and effectiveness. The Joint Staff J8 and U.S. Joint Forces Command have expressed interest in exploring the JT project as the distribution enhancement to the joint suite of requirement models.

Distribution System Improvement. The JT will provide quantitative and qualitative analysis of the theater distribution pipeline by focusing on nodal processes. The JT results will validate and justify future resource expenditures in support of improved joint distribution. JTD will provide these recommendations to improve the physical distribution network and its information flows and management processes. These recommendations will serve as the priority listing for the implementation and funding of future distribution fixes.

Doctrine. The JT will take the best nodal business processes and combine them into a best joint business process for each node type. The Joint Staff J4 will formulate the need for these business processes to be incorporated into joint doctrine. The current plan is to identify them as Joint Warfighting Capabilities Assessment issues.

Training Tool. The modeling tool, and associated analytical data developed throughout the JT, could be used for the development of future joint logistic management training courses at joint or Service logistic education and training organizations. The JT model will provide valuable information on nodal distribution operations. This information will facilitate realistic simulations that will enhance training.

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Joint Shipboard Helicopter Integration Process (JSHIP)

Shipboard helicopter interoperability is a requirement for military forces. Recent history has demonstrated a marked increase of shipboard operations by non-U.S. Navy (USN)/U.S. Marine Corps (USMC) helicopters aboard USN, Military Sealift Command (MSC), and U.S. Coast Guard ships. During Operation SUPPORT DEMOCRACY, the U.S. Army operated OH-58, and CH-47 helicopters from the USS Eisenhower (CVN-69) and USS America (CV-66). The operations of these aircraft and their host ships were restricted due to a lack of helicopter-to-ship certification testing and standardized tactics, techniques, and procedures (TTPs). The Special Operations Forces routinely operate from USN ships during Joint Task Force Exercises (JTFEXs). Shipboard compatibility is an important issue in numerous helicopter and ship operational requirement documents for the Department of Defense (DoD). In the words of RADM D.P. Polatty, DCS for Operations, Plans, and Policy, U.S. Pacific Fleet,

> "JSHIP is the avenue that will maximize our combat capabilities and ensure safe shipboard helicopter operations."

The objective of this Joint Test and Evaluation (JT&E) is to increase operational flexibility and readiness of multi-Service and other agency helicopters onboard USN ships when operating in a joint environment. JSHIP's focus will be to develop a process for certification of Army and Air Force helicopters to operate on-board Navy ships. Execution of this JT&E will give Joint Force Commanders the information needed for an accurate assessment of how joint helicopter operations aboard USN ships will impact the ships' and attached aircraft tactical operations in the blue-water and littoral water environments. The emphasis of JSHIP is tactical interoperability analysis. This analysis focuses on how the warfighters can effectively and efficiently maximize joint interoperability in the shipboard environment.

Problem Statement

> *Current joint shipboard helicopter operations lack coherent, integrated and standardized TTPs which restrict Joint Force Commanders options during contingency operations. Waivers are routinely required for shipboard compatibility and interoperability.*

Joint helicopter shipboard operations have become routine. To effectively address changing threats, commanders need to better understand and define how these operations can be safely conducted without compromising joint helicopter shipboard interoperability.

Feasibility and Necessity

In June 1997 the Deputy Director, System Assessment (DDSA) directed the initiation of a Joint Feasibility Study (JFS) for JSHIP under the auspices the Director, Test, Systems Engineering and Evaluation (DTSE&E), Office of the Secretary of Defense (OSD) and Department of Defense (DoD) JT&E Program. At the conclusion of the year-long study, the JFS team recommended chartering a JT&E program to focus on improving interoperability and safety of

all service rotorcraft with Navy Air Capable Ships.

Purpose and Charter

The JSHIP JT will improve the interoperability and safety of all Service helicopters with Navy air capable ships. Improved interoperability will increase combat capability for helicopter units and will reduce ship combat vulnerability caused by restrictive operations. This test program will address compatibility, procedures, and training issues related to joint shipboard helicopter operations. Another goal of this program is to enhance the safety of joint shipboard helicopter operations. MG L. Dodson, Director of Operations, U. S. CENTCOM, has stated:

> "[JSHIP] is necessary to improve warfighting capabilities and will address the pertinent issues associated with joint shipboard helicopter operations. This is an essential program that is long overdue."

The OSD DTSE&E chartered JSHIP in July 1998. JSHIP has acquired support from combatant Commanders-in-Chief (CINCs) and Service components for aircraft and ship test resources, as well as operational expertise. The Navy is the lead Service with Air Force, and Army participation. CAPT James Thompson, USN, is the Joint Test Director (JTD). The JSHIP JT organization is comprised of military, government, and contractor personnel. The program is scheduled for four years.

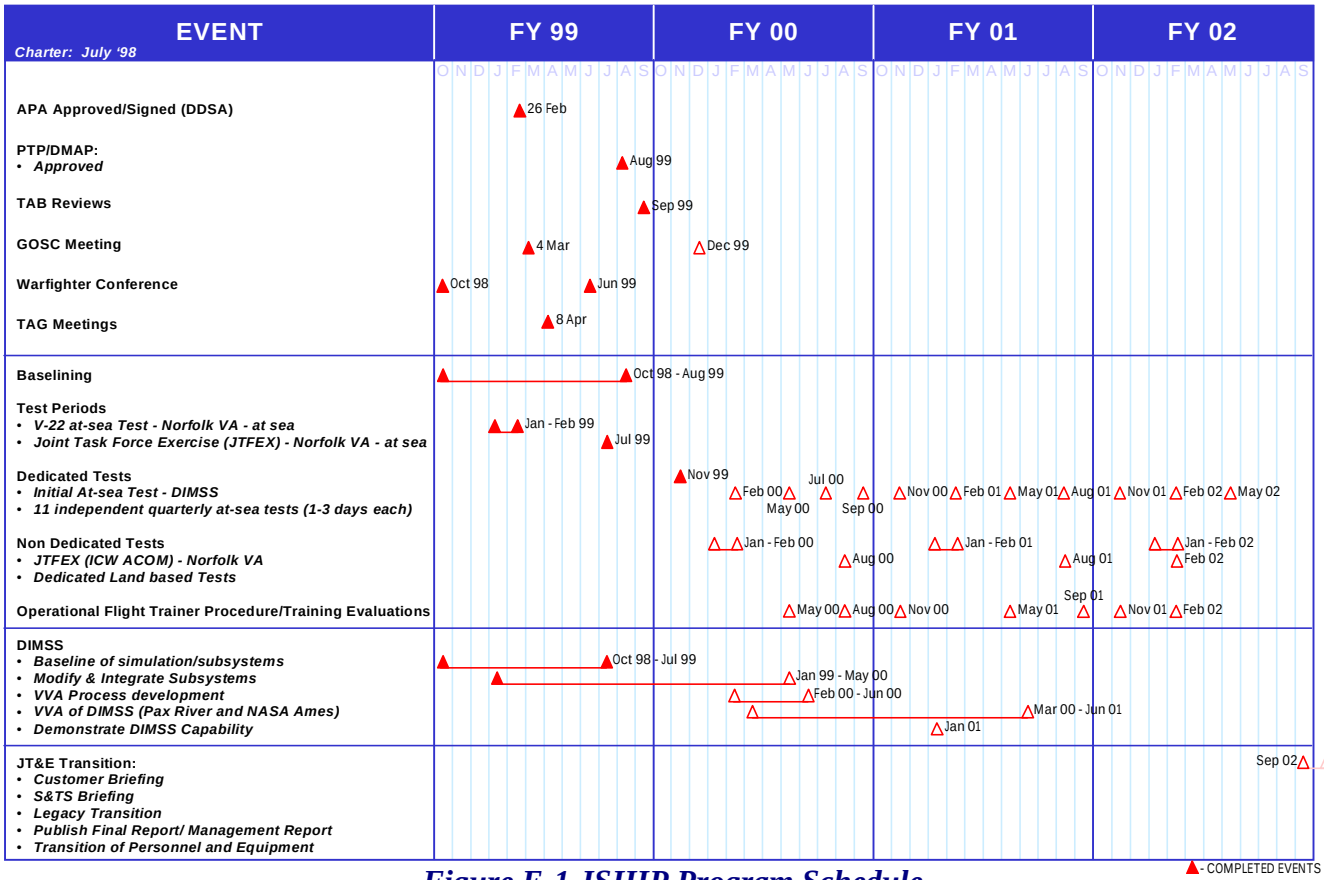

Figure E-1 JSHIP Program Schedule

Program Organization

The JSHIP JT established its headquarters facility in July 1998 at Patuxent River Naval Air Station, Maryland. The Navy is the lead Service, and the Army and Air Force are the participating Services. A total of 10 U.S. military and government civilian personnel were authorized. Contractor personnel account for the remainder of the JSHIP JT staff. Total FY 99 JT manning was 34 government and contractor personnel. FY 00 JT manning stands at 40 government and contractor personnel.

Test Approach

JSHIP will conduct a series of Dedicated At-Sea Tests (DAST) that will utilize resources from the Navy, Army, and Air Force. In addition, JSHIP will capitalize on test opportunities surrounding scheduled exercises of Army, Navy, and Air Force units.

JSHIP will use a four pronged strategy to address its issues. First, look at existing capabilities and establish a baseline. Second, determine the necessary and potential improvements compared to the baseline. Third, design and implement changes where required and feasible. And fourth, test the results for effects on interoperability and capability and provide for the development of JSHIP Legacy Products for the warfighters.

Background

Since chartering, JSHIP has accomplished the following activities:

- Military and contractor manpower within JSHIP are in place;
- Developed the JSHIP Program Test Plan (PTP) which was completed and approved by Deputy Director, Developmental Test and Evaluation and Deputy Director, Operational Test and Evaluation in September 1999;
- Completed crucial negotiations with the Army Test and Evaluation Command (ATEC), CINCPACFLT, and CINCLANTFLT for securing test assets;
- Developed strong Joint Warfighting Committee and General Officer Steering Committee support;
- Developed Joint Service and Service Doctrine Command consensus for enhancement of the joint TTP;
- Conducted and collected data for static gear testing of the UH-60 for Dynamic Interface Modeling System (DIMSS);
- Developed base-line data from three research and development (R&D) motion simulators of the UH-60 series aircraft for DIMSS development;
- Developed Legacy Product timelines, product marketing, and product customer-ship strategies. Also, refined the development of computer-based reference program legacy products; and
- Developed base-line shipboard compatibility data from the 4th Squadron, 2nd Armored Cavalry Regiment, Fort Polk, LA, and the Texas Army National Guard.

1999 Accomplishments

The following are JSHIP's current activities:

- Successfully completed first at-sea test with Army UH-60A and CH-47D helicopters embarked aboard the USS Saipan off the Virginia coast. Data was collected to support validation and developing the airwake and downwash models, and visual, ship motion and aerodynamic models for the DIMSS, and resolution of issues involving compatibility, interoperability, training and procedures;
- Cataloging and analyzing first at-sea test data;
- Continuing development and refinement of Legacy Products;

- Continuing operational baselining efforts with Army, Air Force, and Naval units;
- Continuing development of an interactive CD used for training and procedures by ship's company and embarked aviation units. The computer based reference and training program will provide the warfighter with an easy to use interactive training tool to prepare for joint shipboard helicopter operations. In 1999, JSHIP developed the demo version of this vital training tool; and
- Coordinating 11 remaining DAST evolutions that include:

  DAST 2-LHD, A/MH-6, H-60

  DAST 3-CVN, MH-60, MH-53J

  DAST 4-LPD, MH-53J, OH-58D

  DAST 5-CG, A/MH-6

  DAST 6-LHA, MH-47, UH-60, MH-53J

  DAST 7-CVN, MH-47, A/MH-6

  DAST 8-LHD, AH-64, OH-58D

  DAST 9-CVN, AH-64, UH-60A/L

  DAST 10-DDG, OH-58D

  DAST 11-LPD, AH-64, UH-60A/L

  DAST 12-CVN, CH-47D, OH-58D

Planned Activities

Test activities

- **DAST 2 through 4**: Execution of the four planned tests for FY 00 that continue focus on Wind-Over-the-Deck envelope (WOD) expansion for helicopters, DIMSS data collection, and testing of issues involving ship and helicopter compatibility, procedures, and training.
- **JFX (Joint Fleet Exercise)**: Participation in FY 00. JSHIP will capitalize on these opportunities on both East and West Coasts.

Other activities

- **Conferences/Symposia**: JSHIP attends and participates at technical and operational forums such as the International Test & Evaluation Association, Association of the U. S. Army, Army Aviation Association of America, and the Naval Helicopter Association to disseminate JSHIP legacy information.

Legacy Products

JSHIP is focusing emerging legacy products in three categories: The JSHIP certification Process, ship and helicopter Waiver Reductions/Elimination, and the DIMSS. Potential JT and delivery dates have been proposed. Work continues on the JSHIP Legacy Product Implementation Plan, which will provide a map of how the products will be developed and disseminated to potential owners. JSHIP is currently collaborating with potential product customers and warfighters for concurrence, development, productions, and delivery of user-friendly ship and helicopter operational integration products throughout the course of the JTE.

The JSHIP Certification Process. This legacy product encompasses all of the procedures, planning, conduct of the test methods, and events that formed the bulk of the program. This "Process", when completed becomes a "template" for future similar efforts. Components of the "Process" include the test data base, recommended enhancements to Joint TTP manuals, Service procedural documents, interactive CD for training and procedures for ship's company and embarked aviation unit, modified aircrew training syllabus, and development of a unit at-home training package.

Waiver Reduction/Elimination. This product focuses on the 12 dedicated tests of specific ship and helicopter combinations. The products include the reduction or elimination of waivers through expanding launch and recovery envelopes, ship and helicopter

certifications, and expansion of electromagnetic effects databases. These products will be generated as the tests are completed and provided to the warfighter as quickly as possible.

DIMSS. DIMSS, a twofold modeling and simulation effort, will be used as an engineering tool and training platform. It will support at-sea helicopter flight testing with the potential to develop helicopter launch/recovery envelopes via simulation. Additionally, DIMSS will define and demonstrate a modeling and simulation product that will accurately replicate the aircraft characteristics and pilot workload associated with landing onboard and launching from Navy air capable ships. DIMSS will integrate and enhance eight manned flight simulator subsystem models: Ship dynamic; Visual; Landing Gear; Body Force Cue and Motion; Airwake; Cockpit and Force Feel; and Aerodynamic; Aural; and aircraft Mechanical Characteristics. From these subsystems, DIMSS will develop a process to integrate the subsystems into operational flight trainers to support warfighter training. Additionally, DIMSS will be an excellent product opportunity for acquisition and testers for flight test risk reduction.

PRODUCT CATEGORY	EMERGING PRODUCTS	POTENTIAL CUSTOMERS
PROCESS	-Method/Template for future Joint Ship/Helo Testing	PMA 251D/Navy PEO (A)
	-Test Data Base	Army PEO Aviation
	-Enhancements to Joint Pub 3-04.1 (JTTP)	Joint Staff (J-7)
	-Procedural Recommendations to Service Publications	OPNAV TRADOC/DCS (Doctrine) AFSCO
	-Procedural/Training Video and Interactive Computer Based Training Program (CBT)	CINCLANTFLT N3 FORSCOM G3 TRADOC/DCS, OPNAV
	-Modified Flight/Aircrew Training Syllabi	TRADOC/DES Ft. Rucker
	-Changes to Training Publications	TRADOC/CINC's/ AVTRACEN
	-At-Home Training Package	TRADOC/AVTRACEN
WAIVER REDUCTIONS/ ELIMINATION	-Launch and Recovery Envelopes for specific Ship/Helicopter combinations	PMA-251D/Air 4.3/AMCOM
	-EEE/HERO Data Base	AIR 4.0/AMCOM/JSC
	-Operability Plots for Launch & Recovery Envelopes	Air 4.3/AMCOM/CINC's
	-12 Ship/Aviation Facility Certifications	Joint Staffs PMA-251 NSWC Carderock Joint Spectrum Center
	-HERO Certification Levels	CINCLANTFLT/AIR 4.3 NSWCDD/EEE
DYNAMIC INTERFACE MODELING AND SIMULATION SYSTEM (DIMSS)	-Validated UH-60 & LHA Model	UH-60 PM
	-Subsystem Enhancements: Ship Dynamic Model Visual Model Gear Model Body Force cue & Motion System Airwake Model Cockpit & Force Feel upgrade Aero Model upgrade Aural Model Mechanical Characteristics	PMA 205 NASA-AMES AFSOC Ft. Rucker DES
	-Process to integrate subsystem enhancements into OFT's	MFS (PAX)
	-Conservancy Algorithm Data Model	4.3/AMCOM

Figure E-2 JSHIP Legacy products

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Joint Cruise Missile Defense (JCMD)

Increasing proliferation of cruise missiles (CM) in the arsenals of potential U.S. adversaries has raised the concern of combatant Commanders-in-Chief (CINCs) about the capability of the Joint Integrated Air Defense System (JIADS) to defend against a substantial (CM) threat. Although several individual weapon systems have been tested against CM targets, the JIADS, as a system of systems, has not been thoroughly tested against the CM threat. CMs are relatively cheap, are inherently stealthy due to small size, and can be launched from ground, sea, or air. Moreover, they could be used by terrorist organizations as well as adversary states. In recognition of this potential shortfall in U.S. defense capabilities, U.S. Pacific Command nominated JCMD for consideration as a Joint Feasibility Study (JFS). The Office of the Secretary Of Defense (OSD) directed the JCMD JFS in response to Senior Advisory Council (SAC) recommendations.

Problem Statement

With the aid of a Joint Working Group (JWG), the JFS Team formulated the following problem statement on JCMD for the Joint Test and Evaluation (JT&E):

> *The Joint Integrated Air Defense "Family of Systems" capability to meet the cruise missile threat has not been fully explored.*

In this case, the term "Family of Systems" refers to the collection of individual systems that make up the JIADS. The family includes command, control, and communications assets (E-3 aircraft, E-2 aircraft, ground systems, etc.), shooter assets (fighter aircraft, Patriot, AEGIS, etc.) and all the other principal systems resident in a theater that can perform one or more JIADS functions.

Feasibility and Necessity

The JFS Team conducted the feasibility study from July 1998 to June 1999. During this period, the Team focused on assessing the necessity and feasibility of a JT&E. With respect to *necessity*, JCMD conducted extensive research on Cruise Missile Defense (CMD) and found that:

- The cruise missile threat to U.S. forces is present and increasing;
- Individual system level developmental and operational testing has occurred for many CMD systems, but no significant joint, operationally-realistic testing has been conducted;
- Joint CMD concepts of operation and tactics, techniques, and procedures are nonexistent or outdated and will require revision due to the insertion of emerging technologies and an evolving threat;
- The Joint Theater Air and Missile Defense Organization (JTAMDO) is chartered to look at the 2010 vision of the JTAMD process, but has not completed this task;
- The successful prosecution of cruise missile targets is a potentially costly shortfall in U.S. current warfighting capability; and,
- The joint level is where efforts to improve joint cruise missile defense warfighting capabilities must be directed.

Based on results of the research and application of JT&E necessity criteria from the OSD *JFS Handbook*, the JFS Team concluded that the JT&E was necessary.

With respect to *feasibility*, the JFS Team conducted the test design and feasibility assessment efforts in parallel and it-

eratively to ensure the resulting JT&E could be accomplished. The results included:

- Resources, including test venues, instrumentation, and targets are available to conduct the test and answer the test issues;
- The JT&E can be completed in five years to accommodate budget constraints, yet allowing early results and concurrent feedback to the warfighter;
- CINCs, joint forces, and warfighters feel the results are worth the cost;
- Technologies exist to support the JT&E; and,
- Joint testing is the most effective way to resolve the issues.

The JFS Team assessment found that the proposed JT&E was feasible and could be conducted within OSD budget constraints. In May of 1999, the Senior Advisory Council (SAC) recommended that JCMD be chartered as a JT&E, but within funding constraints for FY 00.

Purpose and Charter

The purpose of the JCMD Joint Test (JT) is to characterize current and near-term effectiveness of a typical U.S. JIADS in countering a cruise missile threat. This leads to the following JT primary objectives:

- Give CINCs a timely, definitive assessment of their capability to conduct a coherent and effective joint integrated air defense versus cruise missiles;
- Leverage existing, operationally realistic exercises to jointly test air defense assets against a representative cruise missile threat;
- Provide a rigorous joint test methodology for JCMD;
- Assess current and evolving CONOPS and TTPs to address the JCMD mission area; and,
- Provide insight into a "Family of Systems" solution to the JCMD mission area.

In response to funding restraints, the JFS Team restructured the JCMD program with a slower ramp-up and extended schedule. The revised program eliminated some early program activities but retained all critical elements of the original JT. Based on the SAC recommendation and the successful restructure, the Director, Test, Systems Engineering and Evaluation signed the JCMD charter on 29 Jul 1999.

The JCMD JT scope focuses on the JIADS "family of systems" in support of the CMD mission. The JT will identify, test, and assess current and enhanced processes associated with joint operations as they influence CMD mission accomplishment. The JT will focus on the five functions of the JCMD kill chain: detection, tracking, identification, allocation, and engagement.

Two JCMD JT issues evolved from the problem statement:

Test Issue 1: What is the current JIADS capability to defeat cruise missiles (2001)?

Test Issue 2: How will near-future enhancements improve current capability as force multipliers (2003)?

Using the dendritic process, the JFS Team developed a series of sub-issues, measures, and data elements structured around the kill chain functions to address the two issues. The resulting JT dendritic structure provided the logical framework for defining and refining the JT test design and identifying the required data collection and analysis processes.

Program Organization

The U.S. Air Force is the lead Service for the JT with participation by the Army, Navy, and Marine Corps. The JCMD program is a tenant at Eglin AFB FL which provides office facilities and infrastructure support in accord with a Host-Tenant Support Agreement. The JCMD Joint Test (JT) has a target strength of 47 in FY 01, to in-

clude both Service and contractor support personnel.

Test Approach

The basic JCMD test approach integrates a series of field tests and simulations in two phases to answer the program issues. Figure F-1 shows the JCMD schedule of major events. Phase 1 will address current JIADS CMD capability, identify potential problem areas, determine potential enhancements, and provide the CINCs an assessment of current JCMD effectiveness. Phase 2 will the tested enhancements and provide the CINCs with both an assessment of JCMD enhanced effectiveness as well as recommendations for further areas of im-

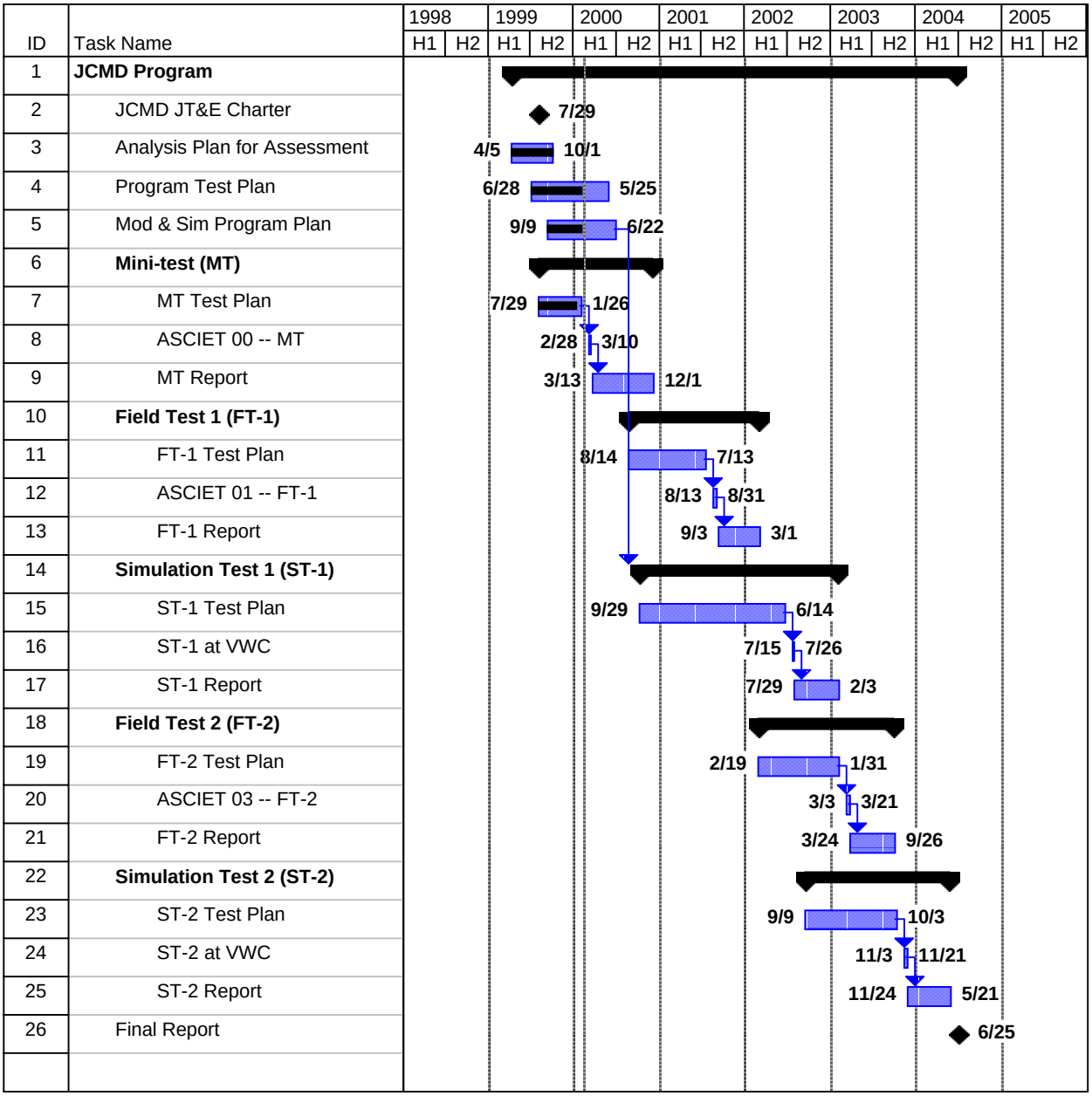

Figure F-1 JCMD Program Schedule

provement. The JT has planned the field tests to integrate with the on-going series of All Service Combat Identification Evaluation Team (ASCIET) evaluations that feature a robust JIADS, focus on air defense as a primary element, and an extensive instrumentation capability for collecting test data. The JT will use the results of the field tests to assess the effectiveness of the JIADS in the CMD role and to update the individual system models to be used in a comprehensive simulation of the JIADS in the CMD role. The simulation will provide the means to address issues (such as multiple, simultaneous cruise missile attacks) that are not feasible in a field test environment.

1999 Accomplishments

Upon charter, the JCMD program began staffing the JT, arranging for facilities, planning the JT in more detail, and preparing for the initial tests.

Program Test Plan (PTP) Development

The JT is expanding the preliminary test concept documented in the APA to prepare the JCMD PTP. The PTP will not only provide more details on the JT activities but also will reflect the results of intense coordination with other organizations involved in the CMD mission area. Such organizations include, but are not limited to: Joint Theater Air and Missile Defense Organization (JTAMDO), BMDO, PACOM, the Air and Missile Defense Program Executive Office (AMD/PEO), and NORAD. The JT is developing Memoranda of Agreement (MOAs) with several of these organizations to establish the scope of mutually supporting activities.

The JT distributed the first draft of the PTP in early November 1999 and will push for final approval in early 2000.

Field Tests

JCMD prepared for its first field activity, a Mini-Test (MT) scheduled to occur in Feb-Mar 2000 in conjunction with the ASCIET 00 evaluation. The JT limited the scope of the initial test in order to solidify the data collection approach, train the team, and assess the ability of the JIADS component systems to detect and track the JCMD-selected cruise missile surrogate target.

The JT has arranged for a cruise missile surrogate target for the ASCIET 00 and will integrate data collection efforts with the ASCIET staff.

The Joint Test Director (JTD) assigned a Test Manager (TM) for MT. The TM assembled the MT test team, to include members of the JT as well as augmentees, and guided the development of the MT Site Test Plan that will provide the details of JCMD participation with ASCIET in planning and conducting the test. JCMD representatives participated in all the ASCIET planning conferences and have developed an expanded MOA with ASCIET that covers JCMD participation in their evaluations from 2000 through 2003.

The JT also developed an MOA with AMD/PEO to collaborate on testing at the ASCIET 00 evaluation. Under the proposed arrangement, AMD/PEO will fly T-38 CM surrogates on the same flight paths as the JCMD-supplied CM surrogates, and the organizations will share data collection and analysis responsibilities.

Simulation Tests

The JCMD will use an existing simulation facility to conduct the major simulations of the JIADS in the CMD role. The JT scheduled a series of meetings and working groups with all the involved organizations to develop the JCMD simulation approach and develop a simulation program plan scheduled for completion in May 00. In the interim, the JT explored the availability, use, and application of constructive simulation tools for predicting the results of Mini-Test (MT) and the first full-scope Field Test (FT), designated FT-1. The Satellite Tool

Kit proved suitable for this purpose, and the JT used it in refining routes for the CM surrogate in MT.

Planned Activities

Over the next four years, the JCMD program will plan and execute a series of field tests and simulations of the JIADS in the CMD role. The PTP will provide the basic road map for these activities that will culminate in a series of legacy products designed to improve US JCMD capabilities.!

Field Tests

As with the MT, the JT will integrate with the ASCIET evaluations to conduct two major live-fly field tests: FT-1 in CY01 and FT-2 in CY03. The JT Phase 1 test, FT-1, will focus on assessing current JIADS JCMD capability. The JT will use the FT-1 results, along with the results of the simulation tests, to discover problem areas and identify potential solutions in the form of enhancements to the JCMD mission area. The JT Phase 2 test, FT-2, will focus on evaluating the effectiveness of the enhancements. The JT will also identify and document any additional problems encountered during FT-2 for further action by the DoD JCMD community.

Simulation Tests

The simulation tests will allow a system of sufficient fidelity to characterize the joint capability to detect, track, identify, allocate, and engage the cruise missile target set in a simulated wartime environment. The JT will use the data collected during the simulation test events to determine how the JIADS receives sensor information, provides an identification, and makes real-time decisions that will effect engagement via the existing, command, control, and communications structures. Comparison of these data with live test data will allow assessment of potential enhancements to the overall JCMD mission effectiveness. The JT will update the enhancements in a model-test-model approach that will ensure the utility of the JCMD simulation architecture as a major legacy product.

The first major Simulation Test (ST-1) in 2001 will provide proof-of-concept data for the JCMD simulation architecture and will allow expansion of the test to examine effects of multiple simultaneous CM attacks and other parameters not testable in a field test environment. After fine-tuning the architecture with live test data from FT-2, the JT will conduct ST-2 in 2003 to further confirm the utility of the architecture and extend assessment of the JIADS into alternate operational scenarios that can include such items as :

- Variations in enemy cruise missile characteristics;
- Different CINC areas of responsibility;
- Alternate JIADS architectures; and
- Improved TTP/CONOPS

Legacy Products

Future products of the JCMD JT will provide warfighters with a baseline effectiveness evaluation of current JIADS capabilities and procedures in meeting the requirements of the JCMD mission area. Once this has been accomplished, the JT will quantify the effects of TTP and CONOPS changes as well as C2, sensor, and shooter systems enhancements to the JIADS in the CMD role. These products will include:

- JCMD-evaluated baseline mission capabilities;
- JCMD-evaluated enhanced mission capabilities;
- Interim capabilities reports and briefings
- Rigorous methodology for JCMD testing
- Information for JTAMDO, CINCs, and Services staffs to use in establishing requirements;

- Updated cruise missile and defensive systems data for establishing the JCMD simulation architecture;
- JCMD simulation architecture for use by DoD customers to evaluate potential changes to CMD capabilities;
- Feedback and inputs for TTPs and CONOPS;
- Additional combat identification inputs for ASCIET; and,
- Required test reports and briefings.

The JT reports will contain most of these legacy products. However, two products require special emphasis: the JIADS JCMD simulation architecture and the final report.

The JIADS simulation architecture will provide a means of examining JCMD effectiveness in specific CINC areas of responsibility. ST-2 will focus on PACOM as the primary area of interest and will model a scenario defined by a specific operations plan selected in coordination with PACOM. This will both demonstrate the utility of the JIADS simulation architecture while providing CINC PACOM with additional insight into current and future JCMD capabilities. PACOM, and other members of the CMD community, can then use the legacy architecture for further exploration of the JCMD mission area.

The final report will document the overall results of the JT and will provide recommendations for the most fruitful areas for exploration in future efforts to improve US JCMD capabilities.

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Joint Global Positioning System Combat Effectiveness (JGPSCE)

The nation's warfighting capability has come to rely heavily on the capabilities represented by the Global Positioning System (GPS). GPS uses deep space satellites to broadcast precise time signals that can be interpreted by ground receivers to derive position, velocity and time data, and provide navigation information. The precise time signals are also critical to operating data links and encrypted communications that provide the information warfare advantage to our forces. Since the Gulf War, the Department of Defense (DoD) has come to rely on GPS more and more, as military receivers have steadily dropped in price and size. Price and size of civilian receivers has fallen even more rapidly, and a significant proportion of military operations and systems incorporate commercial, off-the-shelf GPS receivers to provide either navigation functions or the precise time required for modern communications. Because the GPS signal is broadcast from space at relatively low power, signal reception is easy to disrupt and is susceptible to loss due to interference. Although the vulnerability of some warfighting systems is known, the impact of the disruption or denial of GPS on joint warfighting operations and the means to counter this impact are not known.

Problem Statement

Warfighters are increasingly reliant on GPS. The impact of the loss or degradation of GPS capabilities and the ability to operate despite that loss or degradation has not been systematically tested or evaluated in a joint operational environment.

As reliance on GPS increases, the likelihood of encountering an adversary willing to interfere with GPS is rising as well. Several potential adversaries, as well as some U.S. allies, have fielded GPS jammer systems or systems capable of jamming GPS. Potential threats range from high power airborne jammers to very low power ground based jammers.

One low power jammer was offered for sale at a recent Paris Air Show. This small, cheap, and portable ground-based jammer can operate in several modes, each targeted against a specific aspect of GPS signal processing. Of special interest to people concerned about terrorist activities are very low powered jammers, sufficient to block GPS reception for small areas but capable of being built in large numbers, cheaply. Their low power and small size (they fit inside a soda can) makes these devices extremely difficult to locate.

There are many ways to reduce GPS receiver vulnerability to jamming, but few systems in production incorporate any improved anti-jam features. Warfighters have not defined specific GPS anti-jam requirements to date and the current generation of GPS military receivers and antennas do not have replacements in production as of yet. Further, military users are loath to replace current GPS user equipment due to the huge U.S. investment in current generation receivers. Also troublesome is the fact that some new GPS applications employ civilian receivers as a cost savings measure. As a result, these systems are much more vulnerable to jamming than systems that employ properly encrypted military GPS receivers. In short, the U.S. warfighter faces a di-

lemma. Today's GPS equipment is likely to remain in use for several more years at the least, with anti-jam improvements fielded for only a relatively few systems. For the next five to ten years, possibly longer, U.S. forces are vulnerable to GPS jamming and will have to accomplish missions whether or not GPS-dependent equipment works. Today, the scope of this vulnerability and the means to deal with it and conduct missions successfully in GPS-denied environments are not well understood.

Many operators of military equipment today do not recognize their own dependence on GPS. Unit and theater commanders have little means of knowing when they are experiencing intentional or unintentional GPS interference. In fact, some specific military systems and mission areas have become critically dependent on GPS technology for warfighting capability.

Feasibility and Necessity

The Under Secretary of Defense, Director, Systems Assessment/Test, Systems Engineering and Evaluation directed that a Joint Feasibility Study (JFS) be conducted from July 1998 to June 1999. The purpose was to determine whether a Joint Test and Evaluation (JT&E) was needed to evaluate US military vulnerability to the loss or degradation of GPS due to Electronic Warfare (EW) or due to Electromagnetic Interference (EMI) and develop mitigations to this vulnerability. The study demonstrated the necessity and technical feasibility of executing a JT&E program to focus on the GPS EW impacts on precision engagement missions conducted under the Joint Vision (JV) 2010 concept. As a result, the JGPSCE JT&E was chartered in July 1999. JGPSCE began the staffing process for the contractor, government, and military personnel needed to plan and execute the JT.

Purpose and Charter

The purpose of the JGPSCE JT is to evaluate the impact that EW/EMI might have if encountered by our forces using GPS. This JT will also evaluate the ability of our forces to maintain operational effectiveness in the face of GPS denial by using improved Joint Tactics Techniques and Procedures (JTTPs). Finally, since the information is required to properly assess the impact and the ability to predict consequences, the JT will employ assessment techniques to describe the vulnerability of systems to loss of GPS. Rigorous vulnerability assessments will allow the JT and warfighters to assess impacts and predict consequences when GPS EW/EMI is encountered in the field.

In July 1999, the Office of the Under Secretary of Defense, Director, Test, Systems Engineering and Evaluation (now, Director, Strategic and Tactical Systems) chartered the JGPSCE JT to conduct a JT&E to address three issues:

Test Issue 1: What is the impact of GPS vulnerabilities on joint operational missions that require precision engagement?

Test Issue 2: What changes in JTTPs or system level mitigation techniques improve or maintain joint operational effectiveness in the event GPS capability is lost or degraded?

Test Issue 3: What test methodologies can be employed to characterize GPS vulnerabilities in future acquisition or integration programs?

Program Organization

The JGPSCE charter designates the Air Force as lead service and designates the Navy, Army, and Marine Corps as participating services. As the lead service, the Air Force provides manpower, facilities, and overhead support to the JGPSCE Joint Test (JT). Overhead support includes supplies and equipment, utilities, office automation

computer equipment, and communications. The Air Force Operational Test and Evaluation Center (AFOTEC) hosts the JGPSCE JT and provides this support at Kirtland AFB, NM. The JT is located in Building 20203, one block south of AFOTEC's headquarters building.

While the Air Force serves as JGPSCE's service sponsor and host, the U.S. Joint Forces Command (USJFCOM) has been strongly supportive of the JGPSCE JT&E throughout the nomination and chartering process and serves as JGPSCE's warfighter sponsor and patron organization in the Unified Command structure. In this capacity USJFCOM provides assistance and partnership to JGPSCE in determining warfighter customer requirements, test venue planning, and legacy product definition and disposition. Because of the special relationship JGPSCE enjoys with USJFCOM, the JGPSCE Joint Test Director (JTD) identified the need to locate one JT team member in the Norfolk, VA area to serve as a liaison to the USJFCOM community. As a result, the JGPSCE Navy Service Deputy is co-located with USJFCOM J-7 and J-9 in Suffolk, Virginia, and is hosted by the Joint Warfighters JT&E adjacent to J-9 office space.

Following charter in July 1999 the JGPSCE program was allocated 12 Air Force military positions (seven officer, five enlisted) and eight Army positions (four officer, four enlisted). The Air Force provides the JTD (active duty O-6) as the lead service. The Air Force also allocated six government civilian positions to the program. The Navy and Marine Corps did not support any active duty manpower positions. The Navy did assign one reserve officer, who serves as the Navy JGPSCE Service Deputy. Through the balance of 1999 the JTD worked staffing actions to fill positions as quickly as possible. Air Force military fill actions were processed through existing personnel channels with no significant difficulty. Late in 1999, the Army changed officer assignment policies for joint tests, with the result that JGPSCE initially expected to receive only two of the four assigned officer positions. Efforts to fill a third positions were successful. Finally, the JTD and the Navy Service Deputy continue to work with the Navy and Marine Corps to obtain more full time participation of active duty military from these services on the JT. Efforts are focused on identifying reservists available for recall to active duty for this purpose.

Test Approach

The JGPSCE test approach is based on the premise that open-air field events emulating joint operational precision engagement missions can be conducted, mission effectiveness can be quantified, and that data can be collected to measure degradation in this effectiveness when GPS jamming is applied to the mission scenario. The JGPSCE JT intends to answer the program test issues exclusively through open-air field test data and to use modeling and simulation only for ancillary purposes, such as predicting GPS vulnerabilities, mapping anticipated jammer coverage, and providing real-time and post-test graphics displays of events. The team intends to run predictive models before test events to help maximize test productivity by identifying optimum jammer locations, target locations, operating areas, flight profiles, and so forth. Predictive models will also provide the test team with hypotheses about the expected outcomes of the test events, (e.g. anticipation of the GPS jamming effects that will occur). Actual test results will be compared to these predictions to allow adjustment and improvement in this predictive process through the life of the JT&E. In the open-air test events, a basic four-stage process will be used to collect data. First, mission scenarios will be conducted with no

GPS jamming to collect baseline information on mission effectiveness. Specific missions selected for testing will be coordinated with service customers, based on existing doctrine and operational concepts, and will employ JV 2010 precision engagement. Second, these scenarios will be tested again with GPS jamming applied. Third, the scenarios will be conducted with jamming applied and mitigations to jamming employed by the participants, to determine the extent to which these mitigations can "buy back" effectiveness lost due to jamming. Finally, the scenarios will be conducted with mitigation employed but without GPS jamming to confirm that the mitigations provide a doctrinally and operationally sound employment practice in non-GPS jamming environments.

Although the principal category of mitigations is expected to be changes or modifications to JTTPs, it could include enhancements to systems or enhancements to training. As a general statement, the JGPSCE JT intends to select and prioritize mitigations for testing based on warfighter (customer) inputs. Some mitigations may be developed through analysis of inputs from GPS technical organizations (the GPS Joint Program Office, the 746th TS, the Air Force Space Battlelab, etc). In all cases, JGPSCE's General Officer Steering Committee (GOSC) will have an opportunity to endorse, modify, or reject proposed mitigations.

The JGPSCE test approach also calls for investigating the effects of more than one type of jamming. Testing will begin by examining simple noise jamming on one or both of the GPS downlink frequencies (L1, 1575.42 MHz and L2, 1227.60 MHz). Noise jamming will be applied to emulate known threats (e.g. low power ground-based jammers and higher power airborne jammers and/or EMI platforms). This jamming will be conducted continuously in some tests and intermittently in others. Also, jamming will be conducted to create complete GPS denial to tested missions in some cases and to create degraded GPS reception in others. In all cases, the intent is to create GPS degradation or denial situations to U.S. forces conducting joint operational missions and to determine the impact of this degradation or denial on mission performance, particularly where precision engagement is required. Finally, variations on noise jamming, such as deceptive jamming, may be employed.

The original JGPSCE Analysis Plan of Assessment (APA) proposed three successive field exercises, each in turn examining an increasing level of warfare. As part of the Program Test Plan (PTP) development, this is being reviewed, and alternative plans are being considered in addition to those addressed in the APA. The current state of PTP development suggests that tactical and operational warfare areas may provide better insight into GPS vulnerabilities. The APA concept of three field test events has evolved to a concept of three test phases which sequentially build a basis of knowledge on the system level, tactical level, and operational levels of war. Phase 1 will examine Small Scale Contingency mission scenarios and will investigate system level vulnerabilities but will also demonstrate mission level evaluation methodology and vulnerability assessment methodology. At the present stage of PTP development, Phase 1 testing is planned to include three test events. GYPSY ALPHA, dedicated test at White Sands Missile Range in the fall of 2000, will examine sensor systems. GYPSY BRAVO, a dedicated test at the Marine Aviation Weapons and Tactics Squadron One, Yuma, AZ, in the spring of 2001, will examine weapons systems and GYPSY CHARLIE, a dedicated

ID	Task Name
1	Charter
2	**Test Planning Phase**
3	APA Published
4	Joint Warfighter's Group
5	General Officer Steering Committee
6	PTP Submitted
7	**Phase 1 Testing**
8	Joint Warfighter's Group
9	**TEST GYPSY ALPHA**
10	Joint Warfighter's Group
11	**TEST GYPSY BRAVO**
12	Joint Warfighter's Group
13	**TEST GYPSY CHARLIE**
14	General Officer Steering Committee
15	**Phase 2 Testing**
16	Joint Warfighter's Group
17	**TEST GYPSY DELTA**
18	Joint Warfighter's Group
19	General Officer Steering Committee
20	**TEST GYPSY ECHO**
21	**Phase 3 Testing**
22	Joint Warfighter's Group
23	General Officer Steering Committee
24	**TEST GYPSY FOXTROT**
25	**Legacy Transition Phase**
26	Joint Warfighter's Group
27	Final Report
28	**Closeout Phase**
29	Final Briefing
30	Closedown

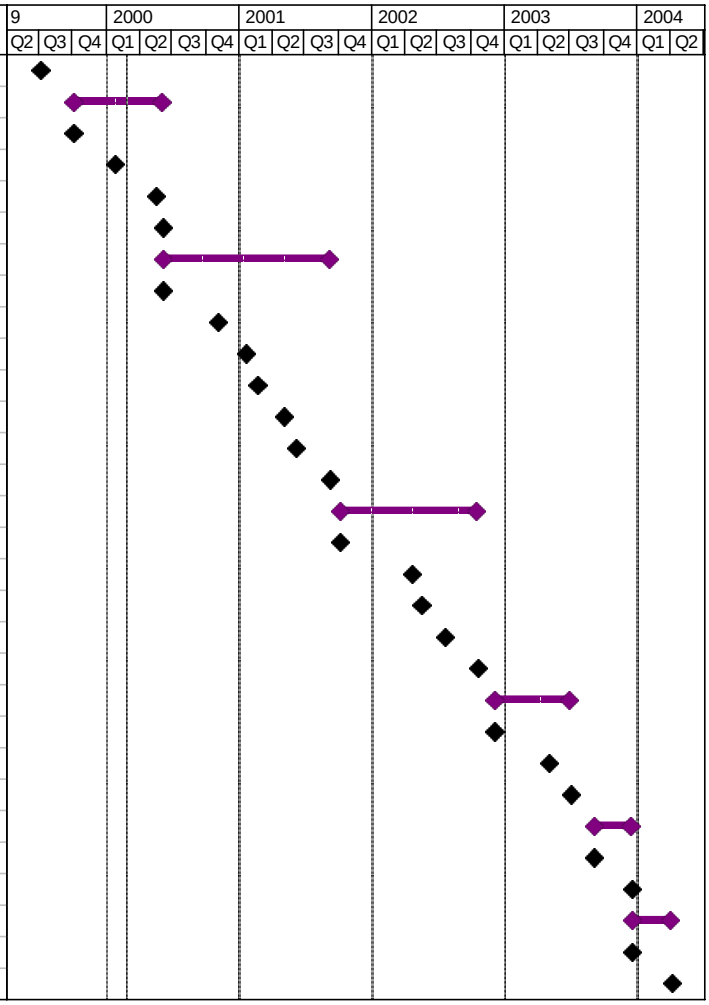

Figure G-1 JGPSCE Program Schedule

test at the Electronic Proving Ground, Fort Huachuca in the summer of 2001, will examine communications systems. Phase 2 testing will focus on Limited Engagement scenarios and will begin examination of the tactical and operational levels of war. Two test events are currently planned. GYPSY DELTA will be a combined event conducted with Fleet Battle Experiment KILO (spring 2002) and will focus on tactical level war. GYPSY ECHO will be combined with UNIFIED ENDEAVOR 2003-1 (fall 2002) and will focus on the operational level of war. Finally, Phase 3 testing will address a Major Theater War scenario and will integrate tactical and operational level of war. One event, GYPSY FOXTROT, will be conducted in combination with USJFCOM's JTFEX 2003-3 in the summer of 2003. The complete schedule for the JGPSCE program as currently planned is illustrated in Figure G-1.

Background

In 1998, the 746th TS successfully advocated a Joint Feasibility Study (JFS) entitled "GPS in a Joint Operational Battlespace Environment," or GPS-JOBE for short. OSD directed this JFS in June 1998. AFOTEC agreed to host the JFS at Kirtland AFB with an initial cadre of personnel provided from the 746th TS and a small contractor workforce. In the fall of 1998 Mr Greg McGill transferred from the JCSAR JT&E staff to become the Joint Feasibility Study Director (FSD) of GPS-JOBE. The GPS-JOBE JFS met the Technical Advisory Board (TAB) for the first time in September 1998, and continued development of the APA.

1999 Accomplishments

The GPS-JOBE JFS met the TAB again in January 1999 and received endorsement of the general approach the team was taking to the APA. In March 1999, Colonel Bob Greenlee was assigned by the Air Force as the FSD, on the expectation that the program would be chartered as a JT&E, and Mr. McGill assumed duties as the JFS Technical Advisor. By the spring of 1999 the JFS team recognized that the name "GPS-JOBE" did not adequately capture the nature of the proposed JT, and the name of the program was changed to JGPSCE. Upon completion of the APA in the late summer of 1999, JGPSCE commenced development of the PTP. This PTP is the basis for subsequent detailed test plans and provides an overarching framework for all future JGPSCE activities. JGPSCE's procedure for PTP development is following established JT&E guidelines for the dendritic process, working from the issues down through measures and data elements. Coupled with the internal process of PTP development, JGPSCE members are travel to various locations to gain insight into GPS applications, operational situations, and test venues. The program is predicated on demonstration of true GPS-dependent system vulnerability through exposure to jamming of GPS signals in an open-air environment, and the JGPSCE members are discovering that many opportunities exist for these kinds of operations. The JT will focus on the processes represented by the Joint Targeting Cycle and where that process could be interrupted through degradation or loss of GPS. Since GPS is being incorporated into more and more systems employed in DoD (sensor, communications, shooters, and weapons), the potential degradation is very large. Setting up the appropriate field events will require insight into the consequences of the loss of GPS on specific systems. Planning and conducting the required field tests should not require system-specific modeling or testing, but rather knowledge of which systems might be affected, and under what circumstances. The PTP will present options and criteria for choosing an optimum path to

minimize test risk while collecting compelling data upon which warfighters can base future actions and decisions

Planned Activities

Over the next year, the JGPSCE JT will complete the PTP, plan and execute test GYPSY ALPHA, begin planning for test GYPSY BRAVO, and complete the legacy transition plan. The JGPSCE charter establishes 31 May 2000 as the deadline for PTP submittal, and PTP will meet the deadline. Detailed test planning for test GYPSY ALPHA will begin early in 2000, and become the main focus of activity once the final draft of the PTP is completed at the end of March. The JT is also preparing for the first Joint Warfighter's Group (JWG) Conference, to be held at the Joint Warfighters JT&E in January, and the first GOSC meeting to be held in May 2000. The JT plans to convene the JWG twice a year through the life of the program. The GOSC will be consulted periodically but probably not more often than once a year. Both will be asked to participate as necessary to ensure that JGPSCE is meeting the needs and requirements of warfighters in the field.

JGPSCE is also preparing Memoranda of Agreement with organizations critical to the success of this program. These include the 746th TS at Holloman AFB, the original sponsor of the Joint Feasibility Study. The 746th TS not only possesses highly regarded expertise in GPS testing, but also is one of the organizations that routinely conducts open air jamming of GPS. Another Memorandum of Agreement is with the GPS Joint Program Office, responsible for all GPS acquisitions, DoD wide.

Legacy Products

JGPSCE is compiling a list of legacy products that transcend the usual, expected JT&E product. Because of the issues involved, there is significant impact in three crucial areas of the DoD, Operations, Intelligence and Acquisition. Actual negotiations to sponsor and maintain each product are awaiting validation by the GOSC in spring 2000. Consideration is being given to hosting JGPSCE legacy products within an existing DoD Information Analysis Center (IAC) or proposing establishment of a new IAC for GPS or GPS vulnerability matters.

Operations. These legacy products affect the manner in which U.S. forces prepare for war, and conduct war. The products apply to training, planning, and actual operations. Given validation by the GOSC, the current proposed JGPSCE legacy products that could profoundly affect our ability to wage war are as follows:

- ***Accepted FAA procedures for granting GPS jamming clearances.*** This could make training operations in which troops experience GPS jamming, a routine occurrence. Experiences in test venues suggest that the key to granting clearances combines planning, preparation, and familiarity;
- ***Training opportunities.*** Current joint exercises and experiments specifically exclude electronic warfare. JGPSCE will demonstrate that GPS jamming will not interrupt training but rather improve training realism;
- ***Training devices.*** JGPSCE will be exploring the use of injection jammers, that use non-GPS radio signals to introduce jamming affects into individual receivers. Widespread use of injection jammers would eliminate the need to obtain clearances for GPS jamming in training exercises;and,
- ***Joint Tactics, Techniques and Procedures (JTTPs).*** The JGPSCE test team will be exploring improved JTTPs, since most interruptions to GPS can be countered by either improved procedures, or shifting to alternate means of navigation or time.

Intelligence. These legacy products affect the manner in which intelligence sources support the warfighters. Intelligence sources must be able to recognize threats to GPS users, make the commander cognizant of the threats, and characterize the threats as environmental, friendly or hostile.

- ***Threat Definition.*** As a direct result of JGPSCE activities, intelligence sources should be able to recognize and correctly classify threats to GPS service. Those threats should be brought to the commander's attention, correctly described as environmental, friendly or hostile. Existing technology can enable detection and categorization of threats to GPS, if utilized correctly;
- ***Threat Concept of Operations.*** The JGPSCE team will employ threats to GPS, as effectively as possible. The Red Forces employed by JGPSCE will not catastrophically disrupt GPS service but will employ current, realistic, DIA-validated threat systems in an intelligent and realistic manner. The result will be a Red Concept of Operations that will be a valuable tool in recognizing and characterizing threats encountered in the field, thus aiding the commander in taking the correct actions in response;and,
- ***Threat Exposure.*** The JGPSCE team will be employing jammers targeted against GPS, giving first-hand experience and evidence of what to expect should our forces encounter this in the field. Knowing the signs and experiencing the impact will help intelligence sources better aid the commander in planning and conducting battle.

Acquisition. JGPSCE will directly benefit the acquisition community. Currently, employing Commercial, Off-The-Shelf (COTS) receivers satisfies most military GPS requirements. COTS receivers are typically cheaper, smaller and more readily available. There is nothing wrong with this, but GPS is easily denied. A robust application usually employs GPS along with either an inertial navigation unit or good clock, depending on application.

- ***Test methodologies for evaluating GPS vulnerabilities.*** Each GPS-dependent system in acquisition must have an assessment (either in DT&E or OT&E) of what happens to performance if GPS is denied. This is equivalent to live fire requirements and need not include actual testing if a reasonable engineering assessment can be obtained. But, each new or upgraded system that goes to the field should be accompanied by a GPS vulnerability evaluation. The evaluation should include a statement of the impact of losing GPS on system performance, the leading indicators of loss or degradation of GPS, and what steps could be taken at the operator level to restore GPS capability, or retain system function without GPS. This is information that could be incorporated in technical manuals and school curriculum;
- ***Standards for GPS vulnerability testing.*** During the Joint Feasibility Study, a review of past events in which GPS receivers were subjected to jamming revealed that results for a given receiver varied according to the test venue. Quite clearly, what is needed are standards for conducting tests of receiver susceptibility to jamming that, when followed, guarantee consistent results regardless of the test venue; and,
- ***Library of GPS Electronic Warfare Effects.*** This was advertised during the Joint Feasibility Study as the Joint GPS Electronic Warfare Effects Library, or JGEWEL. The library will be accessible by either war planners or system designers and offer up-to-date advice on GPS threats, vulnerabilities**,** test results, and ways to guarantee GPS performance.

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Joint Advanced Distributed Simulation (JADS)

JADS was chartered to investigate the utility of Advanced Distributed Simulation (ADS) as a methodology for both developmental test and evaluation (DT&E) and operational test and evaluation (OT&E). JADS was tasked to determine the utility of ADS at its current level of maturity, identify the critical concerns, constraints, and methodologies associated with using ADS, and identify growth requirements to help ADS meet the needs of the Test and Evaluation (T&E) community.

In order to provide tangible proof of the utility of ADS as a methodology, JADS performed three tests: the System Integration Test (SIT), the End-to-End (ETE) Test, and the Electronic Warfare (EW) Test. These tests addressed major classes of systems: precision guided munitions; command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR); and EW as well as numerous other T&E applications both developmental and operational.

To maximize the breadth of JADS findings on ADS utility to T&E, JADS leveraged off other activities utilizing ADS. gathered advanced technology demonstrations, and other T&E efforts. Data and results were gleaned from these activities and included in JADS reports.

Problem Statement

The T&E community is faced with many testing shortfalls. These include an insufficient number of test articles, an insufficient number of threats, and an inadequate representation of friendly force interactions. The community is also faced with reduced funding and the requirement to test and field new, more advanced, and interoperable weapons systems. Under current and future budget constraints, the T&E community needs advanced, cost-effective test methodologies to provide the necessary capabilities for evaluating these future systems. The Defense Science Board concluded in a 1992 study that the Department of Defense should use ADS to fully link test ranges and facilities, training ranges, laboratories, and other simulation activities to improve testing and training. ADS uses rapidly evolving information systems technology to link ranges, laboratories, and simulations at multiple locations to create realistic, complex, synthetic environments that can be used for test and training purposes. However, T&E and acquisition professionals have been reluctant to use this untried technology. They have doubts as to whether ADS can deliver valid, T&E-quality data, what the costs of using ADS are, and how to use ADS in the T&E of various types of systems. JADS was chartered to address these concerns.

Feasibility and Necessity

The JADS Joint Feasibility Study started in July 1993 and was originally directed by Colonel Charles Griffin, now the Vice-Commander of the Air Force Operational Test and Evaluation Command (AFOTEC).

The Senior Advisory Council recommended the JADS Joint Feasibility Study for charter in July 1994.

Purpose and Charter

The purpose of JADS was to develop and validate a testing methodology that has broad multi-Service application. JADS investigated the utility of ADS, including Distributed Interactive Simulation (DIS), for T&E. JADS identified the critical constraints, concerns, and methodologies when using ADS and the requirements that must be introduced in ADS systems if they are to support a more complete T&E capability in the future. Now that all testing activities at JADS are completed, the primary purpose has shifted from testing to providing legacy products and information to the T&E and acquisition communities and providing assistance to testers struggling with the complex issues that JADS was able to overcome.

The Office of the Secretary of Defense, Deputy Director, Test, Systems Engineering and Evaluation chartered JADS in October 1994.

Program Organization

The Air Force leads the program with Army and Navy participation. Colonel Mark E. Smith is the joint test director. When fully manned, JADS employed 23 Air Force, 13 Army and two Navy personnel. Due to the impending shutdown in March 2000, manning is down to 13 Air Force, two Army, and one Navy personnel.

Test Approach

The JADS test approach was not to focus on a particular system under test but rather focus on the benefits, costs, and per

JADS Schedule

Milestone	FY00			
Charter: Oct 94 (amended Aug 96 to include EW) **Analysis Plan for Assessment:** May 96 **Program Test Plan/Data Management and Analysis Plan:** Basic -Feb 96, EW -Nov 97 **Technical Advisory Board reviews:** May 95, Jan 96, Jun 97, Jan 98				
The Utility of Advanced Distributed Simulation for Precision Guided Munitions Testing, May 98				
The Utility of Advanced Distributed Simulation for Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance Testing, Aug 99				
The Utility of Advanced Distributed Simulation for Electronic Warfare Testing, Nov 99	◆			
JADS Executive Report on the Utility of Distributed Testing, Dec 99	◆			
JADS Final Report, Dec 99	◆			
JADS deactivation, March 00		◆		

Figure H-1 JADS Program Schedule

formance of using ADS to conduct distributed testing. Additionally, JADS used results from tests conducted by outside organizations to expand their conclusions to other classes of systems and other acquisition phases.

Background

System Integration Test.

The SIT evaluated the utility of ADS in performing T&E of precision guided munitions. The Air Intercept Missile (AIM) -9M, Sidewinder missile and the AIM-120 Advanced Medium Range Air-to-Air Missile (AMRAAM) were chosen as the representative precision guided munitions to introduce ADS as a testing methodology. Both DT&E and OT&E applications were explored in the two-phase SIT. Phase 1, the Linked Simulators Phase, used manned flight simulators representing the launch and target aircraft linked to a missile Hardware-In-the-Loop (HWIL) simulation facility. This allowed JADS to evaluate ADS as applied to the testing of an air-to-air missile against a target using missile warning and countermeasures systems. Phase 1 was completed in November 1996. Phase 2, the Live Fly Phase, used live launch and target aircraft linked to an AMRAAM HWIL simulation facility. This provided the ability to evaluate how well ADS could be used to link live fire radar data link signals to a missile in a HWIL facility. Phase 2 was completed in October 1997.

End-to-End Test.

The ETE Test evaluated the utility of ADS to support testing of C4ISR systems. The test used the Joint Surveillance Target Attack Radar System (Joint STARS) as one component of a representative C4ISR system. The ETE Test also evaluated the capability of the JADS Test Control and Analysis Center, Albuquerque, NM, to control a distributed test of this type and remotely monitor and analyze test results. The test concept was to use ADS to supplement the operational environment experienced by the E-8C and Light Ground Station Module (LGSM) operators. By mixing available live targets with targets generated by a constructive model, a battle array approximating the major systems present in a notional corps area of interest would be represented. By constructing a network with nodes representing appropriate C4ISR and weapon systems elements, a more robust cross section of players was available for interaction with the E-8C and LGSM operators. The ETE Test consisted of four phases that started with infrastructure development and ended with live flights of the E-8C (Joint STARS) aircraft.

Electronic Warfare Test.

The EW Test evaluated the utility of ADS to support EW testing by enhancing the EW test process. The scenario JADS was directed to implement used a single fighter aircraft equipped with a Self-Protection Jammer (SPJ) penetrating enemy airspace and then returning. During penetration, the aircraft was engaged by surface-to-air threats. The test design used three phases to examine different developmental phases of the jammer, although the phases were not executed in the chronological order of a real development test. Phase 1 established a performance baseline on the Open Air Range (OAR). This phase was executed first to generate information for building the subsequent ADS-based test phases. Phase 2 used an ADS-based test environment to recreate the OAR test using a digital system model of the jammer that mimics tests occurring during the early developmental stages of the acquisition process. Phase 3 used the Phase 2 ADS test environment with an actual jammer installed on an aircraft. In this phase, the aircraft was in an installed systems test facility mimicking testing accomplished late in the development cycle of the

jammer. Typical SPJ measures of performance and measures of effectiveness were collected in each phase and compared to show the impacts of the ADS test environment. This process allowed JADS to directly assess the validity and credibility of the data produced by the ADS environment.

1999 Accomplishments

ETE Test.

Phase 3, completed in March 1999, transitioned portions of the Virtual Surveillance Target Attack Radar System (VSTARS) emulation to a live E-8C aircraft. The aircraft was put through extensive verification and validation testing to ensure that the aircraft functioned properly and that the elements of the synthetic environment interacted properly with the aircraft. Testing was also done to ensure the aircraft was still able to communicate with an actual light ground station module (LGSM).

Phase 4, also completed in March 1999, took advantage of the successful integration during previous phases and performed an ADS-enhanced live open air test. It evaluated the ability to perform test and evaluation of the E-8C and LGSM in a synthetically enhanced live test environment. The test culminated with flights of the E-8C over Fort Hood, Texas, where the ground-based LGSM operators were able to observe live, virtual, and combined live/virtual areas of operation and a virtual Army Tactical Missile System battalion was able to target and eliminate virtual ground targets during the test.

The ETE Test team determined that ADS testing can be beneficial for test planning, rehearsal, and execution of C4ISR systems testing and can result in valid data being collected. They also identified critical constraints, concerns, and methodologies associated with using ADS for test and evaluation. Finally, the ETE Test team developed and assessed test control and data collection methodologies useful for ADS testing.

The following reports were published by the ETE Test team in 1999:

- *End-To-End Test Interim Report, Phase 2*, MAJ Paul Hovey, February 1999.
- *Phase 2 Verification and Validation Report for the End-to-End Test*, Mr. Gary Marchand, February 1999.
- *End-To-End Test Interim Report, Phase 3*, MAJ Paul Hovey and Mr. Gary Marchand, May 1999.
- *End-To-End Test Interim Report, Phase 4*, MAJ Paul Hovey and Mr. Gary Marchand, August 1999.
- *Phase 3 and Phase 4 Verification and Validation Report for the End-to-End Test*, Mr. Gary Marchand, August 1999.
- *The Utility of Advanced Distributed Simulation for Command, Control, Communications, Computers, Surveillance and Reconnaissance Testing*, LTC Patrick M. Cannon, Maj Mark F. Scott, and Dr. Leslie McKee, August 1999.

EW Test.

The final test phase (Phase 3) was completed in April 1999. The system under test was the ALQ-131 self-protection jammer installed on an F-16 aircraft located in an integrated systems test facility at the Air Combat Environment Test and Evaluation Facility (ACETEF), Patuxent River Naval Air Station, MD. The data collected from Phase 1 and the network infrastructure created in Phase 2 supported the Phase 3 test. Three facilities participated in this test. The plane with the ALQ-131 was hung in an anechoic chamber at the ACETEF. The ACETEF also contained a High Level Architecture (HLA) federate that provided the radio frequency stimulation to the ALQ-131, while software and hardware developed by GTRI captured the ALQ-131 output and propagated the digital modes and codes

across the federation to both the Air Force Electronic Warfare Environment Simulator (AFEWES), Fort Worth, Texas, and JADS. The AFEWES simulated the threat environment using four hardware-in-the-loop simulators and interfaced with JADS and ACETEF through an HLA federate. The last site, JADS Test Control and Analysis Center (TCAC), served as the test control facility. The TCAC provided the test control measures, and the HLA federates developed by GTRI published scripted aircraft time-space-position information, simulated threat activation times, and specific threat modes and codes.

The EW Test Team determined that ADS has the greatest potential for testing systems of systems testing such as testing electronic support systems. Utility also exists with integrated EW systems especially where a single facility is unable to test all the EW functions simultaneously in a single test event.

Reports published by the EW Test team in 1999:

- *Electronic Warfare Test, Interim Report, Phase 1*, Maj Darrell L. Wright and Mr. James Charlton, March 1999.
- *Electronic Warfare Test, Interim Report, Phase 1 (Classified),* Maj Darrell L. Wright and Mr. James Charlton, October 1999.
- *Electronic Warfare Test, Interim Report, Phase 2*, Maj Darrell L. Wright, September 1999.
- *Electronic Warfare Test, Interim Report, Phase 3*, Maj Darrell L. Wright, November 1999.
- *Electronic Warfare Test, Interim Report, Phase 2 and Phase 3 (Classified),* Capt Roman M. J. Nation, Capt Sandra Smith, Mr. John O. S. Williams, December 1999.
- *The Utility of Advanced Distributed Simulation for Electronic Warfare Testing*, Maj Darrell L. Wright, November 1999.

Other Reports Published by JADS in 1999:

- *JADS Special Report on Networking and Engineering*, MSgt Charles Ashton, August 1999.
- *JADS Special Report on Verification, Validation and Accreditation of Distributed Tests*, MAJ Michael Roane and Mr. Gary Marchand, October 1999.
- *A Test Planning Methodology - From Concept Development Through Test Execution*, Mr. John Reeves and Dr. Larry McKee, November 1999.
- *JADS Special Report on Programmatic Challenges to Distributed Testing*, Lt Col James M. McCall, Mr. John Reeves and Dr. Larry McKee, November 1999.
- *JADS Special Report on the Costs and Benefits of Distributed Testing*, MAJ Michael L. Roane and Ms. Norma Slatery, December 1999.
- *JADS Special Report on Distributed Test Control*, Mr. Earl E. Barnes, December 1999.
- *JADS Executive Report on the Utility of Distributed Testing*, Mr. Eric L. Keck, December 1999.
- *JADS Final Report*, CPT Noel N. Pratap, Capt Sandra Smith, Capt Justin B. Peddicord, Capt Roman M. J. Nation, MAJ Michael L. Roane, December 1999.

Planned Activities

Future activities consist of getting the results into the hands of the relevant communities and helping them to implement ADS technologies. An extensive briefing trail is in place and includes key offices throughout the Department of Defense. Briefings are scheduled for Army, Navy, and Air Force leaders who are involved in T&E and acquisition.

Extensive activities are also scheduled to find new positions for JADS personnel, finish distributing equipment, and close out all administrative activities before JADS deactivates in March 2000.

Legacy Products

The potential of ADS as a feasible test tool, one with the ability to overcome many traditional shortcomings in present day T&E methodologies, is exciting. JADS investigated this potential and is now letting the T&E and acquisition communities know the true power, and associated limitations, of ADS. The legacy program is being executed so that this vital information gets to the proper organizations in a format they can understand and use.

The legacy of the JADS Joint Test (JT) will cover a broad range of issues for the T&E community. JADS has defined its legacy program as "all actions JADS takes to ensure that its products are fully incorporated into the user community." There are three aspects to this effort.

- ***Educate the user community and instill ADS into its thought processes.*** JADS developed a training course that was offered at JADS and off site upon request. Over 1,400 people received this free training. The course covered ADS concepts, the potential benefits of using ADS' an overview of the JADS test events, lessons learned from completed tests, and methodologies for assessing and using ADS. The course described ADS, encourages thinking and planning processes that include ADS, and includes recommendations on how and when it might be used. In addition, JADS presented more than 60 technical papers at over 50 symposiums and workshops focusing on simulation and T&E;
- ***Equip the user community with the proper ADS knowledge, procedures, and tools.*** JADS is developing reports, training modules, roadmaps, checklists, etc., so that testers can assess whether ADS is right for them in a particular situation. JADS also produced products so that, having made the determination that ADS is worthwhile in their situation, testers can develop plans to apply ADS. Procedures are being developed for communication, network design, installation, and check-out; ADS Verification, Validation, and Accreditation (VV&A); test control and analysis; and security. Specialized software tools have been developed for network monitoring, data collection, and real-time data analysis. Products developed will span the entire spectrum of ADS-enhanced testing from evaluation to planning to execution and analysis. JADS will include information in a variety of media about the prudent uses of ADS, technical knowledge, VV&A strategies, pitfalls, lessons learned, and a final interpretation of results; and,
- ***Institutionalize the products of the JADS JT for lasting value.*** JADS is working with a variety of agencies and repositories to arrange for the long-term availability of JADS reports and products. Once these arrangements have been formalized, the T&E community will be told where they can get this information. In this way, future T&E professionals can access what was learned and reap the benefits long after JADS has ceased to exist. Additionally, as experience in the use of ADS as a testing tool proliferates, future efforts may delve further into this new technology. The groundbreaking work of JADS will then be available as a starting point for further study.

JADS was responsible for the production of two important products. The first was a DIS-compliant version of the Army's interactive simulation called Janus. JADS provided funding to the Army's Training and Doctrine Command Analysis Center, White

Sands Missile Range, NM, to make the required improvements to Janus. These improvements were incorporated into the baseline version of Janus giving all users the capability to conduct DIS-compliant exercises or tests. Many organizations are already taking advantage of these dynamic new capabilities. The second product developed as a direct result of a JADS test was the VSTARS. It is an emulation of all of the radar functionality from the E-8C portion of the Joint STARS system. VSTARS is also facing a bright and useful future as many organizations across the country are looking at incorporating VSTARS into their tests, exercises and training systems.

JADS also developed products in-house with the help of contractors. The first product was the Analysis Toolbox. It is a set of C++ routines integrated into a single user interface that allows users perform near real-time and post-test analysis by graphically plotting test data consisting of Protocol Data Units (PDU). This product provided dynamic capabilities that did not exist before JADS. The second product was a runtime interface (RTI) logger for HLA simulations that resides between the federate software and the application program interface. This product also filled an analysis void and has been widely distributed by JADS for use by other organizations.

Other products from JADS include almost forty reports, a quarterly newsletter, a World Wide Web site, a variety of brochures, information booths at T&E conferences and symposiums, technical papers, an ADS training course, videos, and interactive multimedia CD-ROMs. Perhaps more importantly, JADS has a variety of intangible products. Some of these products include knowledge and experience gained by T&E facility personnel as a result of the tests; infrastructure and computing power paid for by JADS but distributed to the appropriate facilities upon completion of tests; increased willingness of testing professionals to consider ADS as a possible solution to their testing challenges; and the tools to evaluate ADS for how it may fit a particular application.

The legacy of JADS will be more than a voluminous report. It will be real change, where warranted, and the knowledge and tools needed to implement those changes for better T&E in the future. Better T&E can mean T&E at lower cost, more complete T&E at the same cost, higher cost but greatly enhanced fidelity, or in some cases, the only way to test because of safety and/or environmental constraints. Better T&E through the intelligent use of ADS is all of these and more. Giving our warfighters the best we can is our ultimate goal. The proper use of ADS will help create weapon systems with lower overall life-cycle costs that come from better design, testing, and evaluation before being put into the hands of our warfighters. This is the true legacy of the JADS JT.

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Joint Electronic Combat Testing Using Simulation (JECSIM)

The JECSIM program began as an attempt to resolve problems experienced in Open Air Range (OAR) testing. The Air Force Operational Test and Evaluation Center (AFOTEC) proposed the creation of a set of common flyout models for threat systems to Air Force Test and Evaluation in 1993. The Navy and Army were invited to participate in this effort. By late 1993, a Flyout Model Working Group met to define a common range architecture and model set. In mid-1994, discussion focused on the issue of modeling semi-active and/or active threat systems. The culmination of these initial efforts was a Joint Feasibility Study (JFS).

Problem Statement

There are major limitations in the current capability to evaluate the effectiveness of countermeasures, including Electronic Countermeasures (ECM). The availability of threat systems is severely limited, and simulators depend on the degree and accuracy of intelligence data. Live fire tests are limited and are often used against unrealistic drone aircraft. Additionally, the high cost of field testing prevents comprehensive evaluations against a wide range of engagement conditions that can have profound effects on ECM effectiveness. Endgame evaluations (Probability of Kill (Pk)) are also limited. In addition, test results against threat systems cannot be effectively extended to other variants of the same system.

Modeling and Simulation (M&S) plays an essential role in the Department of Defense (DoD) life cycle process. M&S is used extensively to support DoD decision-making bodies such as the Joint Requirements Oversight Council, the Defense Planning and Resources Board , and the Defense Acquisition Board. M&S also plays an important role in the education and training of the military forces. The systems engineering process, essential to the program office and the decision-making bodies, is intended to provide disciplined engineering during all system life cycle phases. Throughout this process, analysis forms the foundation for the systems engineering. The keys to successful analyses are the tools used, specifically M&S.

Because of budget pressures, downsizing, consolidation, acquisition reform, technology advancements, and realignment, there is a major emphasis on test and evaluation supported by simulation to become allied with acquisition programs from their inception. M&S applications are needed to support test design and extrapolate test data to the engagement/mission and theater levels. The interdependent manner in which simulation and test tools are applied to support the acquisition process and remain available for reuse throughout the system life cycle is key to cost-effective acquisition. Funding shortages, complex systems, and the overall reduction of resources have caused the Services to take a closer look at M&S applications. A key finding of this effort was the lack of a standard approach for M&S application during requirements planning, system acquisition, and operation and support phases.

Feasibility and Necessity

The purpose of the JFS was to conduct an in-depth analysis to assess the need and feasibility of performing a Joint Test &

Evaluation (JT&E). The JFS concluded that a JT&E was necessary and feasible. The JECSIM Joint Test (JT), with Navy, Air Force, Army, and intelligence community participation, was deemed necessary to answer the following questions:

- What is the role of M&S in Test and Evaluation (T&E), e.g., how well can models predict real-world test results and be used in conjunction with OAR and Hardware-In-The-Loop (HITL) in the evaluation of threat semi-active, anti-air missiles versus Electronic Countermeasure (ECM) systems?
- What data should be collected for model validation?
- How can models required for simulation of semi-active, anti-air missiles from launch through endgame encounter be integrated and validated to the level required to produce credible results? This encompasses component models used in HITL and Ground-Mounted Seekers (GMS). M&S applications are required to predict endgame geometry and fusing to the accuracy required for Pk assessment.

The JFS also concluded that the synergistic use of all digital M&S in conjunction with HITL, GMS, and OAR testing could provide qualitative methodologies for T&E of semi-active systems against cruise missiles, fighters, and bomber-size aircraft in ECM environments.

The JECSIM Analysis Plan for Assessment (APA), prepared in July 1996, documented the JFS. The APA also included a projection of resource requirements, e.g., funding, test assets, personnel, contractor support, exercise participants, administration, and facilities. The APA addressed issues that the JECSIM JT would resolve, and how the JT would resolve them, and established a support base for the JT. The APA also detailed the JT purpose that is to determine the validity of M&S required for use in conjunction with HITL and OAR testing to enable the assessment of credible performance Measures of Effectiveness (MOEs) with respect to missile, target, and ECM. Furthermore, the APA established methods that illustrate how the use of credible M&S can be used in the performance of T&E (in conjunction with semi-active Surface-to-Air Missile [SAM] systems).

Purpose and Charter

JECSIM was chartered August 23, 1996 with participation from the United States Army, Navy, and Air Force. The Navy has been designated as the lead Service. JECSIM was chartered to investigate the use of digital models and simulation in the test and evaluation of threat semi-active anti-air against friendly forces Electronic Countermeasures (ECM), fighter, bomber, and helicopter utilized in both Developmental Test and Evaluation (DT&E) and Operational Test and Evaluation (OT&E). JECSIM will evaluate the current use of existing M&S of semi-active threats and ECM systems for T&E; identify the critical constraints, concerns, and methodologies when using these M&S for T&E; and finally, identify the requirements that must be introduced into M&S if they are to support a more comprehensive T&E capability in the future.

JECSIM is investigating the utility of digital models and simulations in the test and evaluation of threat semi-active missile systems against friendly forces' electronic counter measures. While M&S has always been a critical element of T&E, technological advances and budget cuts have fueled a greater emphasis on improving and applying M&S, particularly in guiding DoD's "what to buy" decisions. As a result, the role of M&S in T&E is evolving from one of support in test planning to one of interpretation of the impact of test results; extension of test results to other scenarios, systems, and environments; and the generation of data for operation assessments.

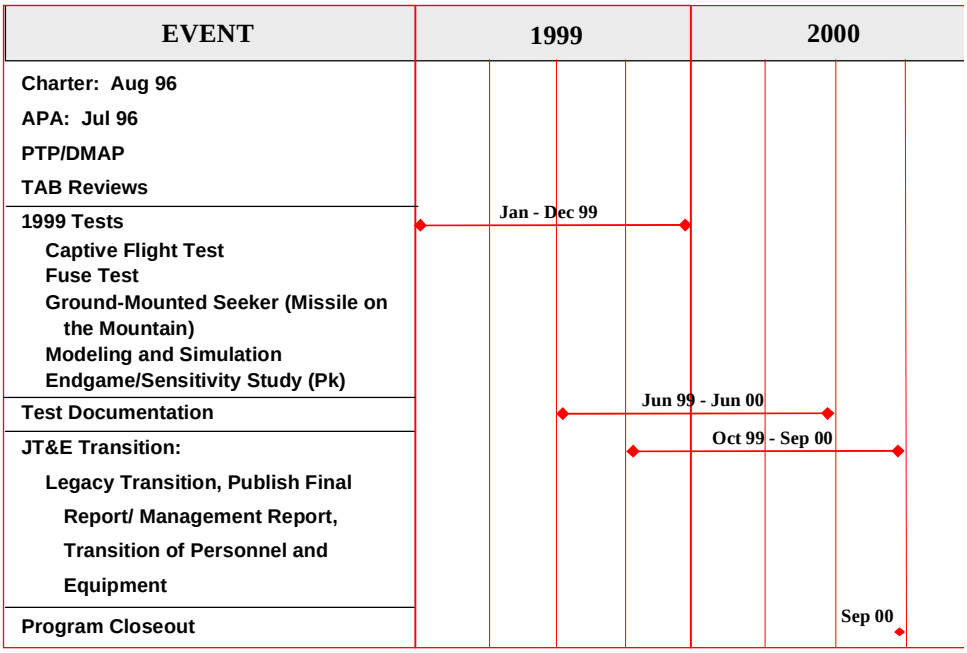

Figure I-1 JECSIM Program Schedule

Program Organization

The JECISM JT established its headquarters facility in July 1996 at China Lake, CA. The Navy is the lead Service, with the Army, Air Force, and MSIC as participating Services. A total of 11 U.S. military and government civilian personnel were authorized. Contractor personnel make up the remainder of the JECSIM JT staff.

Test Approach

The current "test, fix, test" methodology for planning development programs will soon be replaced by a "model, test, model" approach that will define the role of M&S in T&E and will define the methodology for M&S Verification and Validation (V&V). The process for meeting these objectives is described in the JECSIM JT Program Test Plan (PTP). The JECSIM JT will compare data collected at various laboratories, HITL facilities, and OARs with predictions using M&S tools designated in the Joint Modeling and Simulation System (J-MASS). Additionally, the JECSIM JT will study the Pk sensitivity to variances in endgame parameters using the Joint Services End-game Model (JSEM).

Background

Live Fire Testing

Early in the planning and nomination phases, it was known that a series of SA-6 live fire tests were being planned by another testing activity to reach an acquisition decision on a countermeasures device. It was briefed that JECSIM planned to leverage on these tests for the purpose of data collection and later comparison to models. The tests occurred during the feasibility study phase; however, JECSIM was able to influence the missile calibration, characterization, and telemetry in such a fashion that valuable data were obtained.

Laboratory Testing

The purpose of the laboratory testing was to characterize the missile seekers and calibrate the missile accelerometers and gimbals. The seeker characterization was

accomplished by measuring the responses and assemblies of the missile seeker subcomponents to specific input signals. The accelerometers were calibrated by mounting the missile seeker and autopilot section of the missile on a centrifuge and rotating the missiles at various angular rates, imposing known forces on the missile. The longitudinal accelerometer was calibrated by mounting the missile body parallel to the centrifuge arm; the lateral accelerometers were calibrated by mounting the missile body perpendicular to the centrifuge arm. The tests were conducted at the Missile and Space Intelligence Center (MSIC) at Redstone Arsenal, AL.

Hardware-in-the-Loop Testing

The purpose of the HITL measurements program is to characterize the response of the missile seeker to benign ECM. ECM devices of interest include the ALE-50 towed decoy and AN/ALQ-165 ASPJ device. The data collected from HITL testing will support the evaluation of the composite missile simulation, seeker component model, ECM component model, and fuse component model. A detailed Test Activity Plan for HITL has been completed and the test is to be conducted at the Radio Frequency Simulation System facility located at Huntsville, AL.

Radar Signature Tests

The purpose of the Radar Cross Section (RCS) measurements program is to provide data to assess near- and far-field RCS prediction codes. JECSIM will collect monostatic and bistatic radar signature data on the QF-4E and F/A-18 to validate near- and far-field radar signature prediction codes. This measurement program will include QF-4E measurements at the RATSCAT facility and AH-64 LONGBOW measurements at the Junction Ranch Radar Signature Measurement Range. The models supported by this testing are near- and far-field RCS prediction codes (XPATCH, NcPTD, and N-point Scatter models).

1999 Accomplishments

Captive Flight Test

The purpose of the Captive Flight Test (CFT) measurements program is to provide data on seeker interaction with real targets, with and without ECM. The CFT provides the most realistic clutter environment with the ability to position the threat missile seeker close to an actual target where test data can be obtained. Targets of interest include the B-1B and F/A-18.. The data gathered from CFT testing will support the evaluation of the missile seeker, clutter model, and target RCS and glint (XPATCH, NcPTD, N-point scatter) models. Modifications have begun and testing will be completed at Naval Air Warfare Center, China Lake, CA.

Fuse Test

The purpose of the fuse test program is to provide a database of fuse antenna-target interaction data that covers a wide variety of missile-target intercept conditions to validate the fuze model elements of antenna patterns, target power return, and threshold detection. This validation will be accomplished using comparisons of model outputs (predictions) with data collected from a calibration target and a fighter-sized target. The MESA fuse test will provide verification of the monostatic near-field target model, fuse near-field antenna patterns, and fuse antenna-target interaction. The outdoor antenna range will provide elevation and azimuth, two-way, and far-field sensitivity patterns for transmit-receive antenna pairs mounted in a missile body section. Models supported by this testing are the near-field target RCS model (NcPTD, N-point scatter) and the near-field fuse antenna model. The MESA test facility and its operational and support personnel will be used.

Ground-Mounted Seeker (Missile on the Mountain)

The purpose of the GMS test program is to provide seeker interaction with real targets, with and without ECM. The GMS facility provides one of the most realistic test environments of any test facility. Targets of interest include the B-1B with the ALE-50 towed decoy and the F/A-18 with the AN/ALQ-165 ASPJ. The data gathered from GMS tests will support the evaluation of the composite missile simulation, seeker component model, target signature model, and the characterization of a second EC device.

Modeling and Simulation

JECSIM will test semi-active threat seeker/fuse configurations to provide validation data for digital models for use in ECM. M&S tests will provide the digital simulation data that will be compared with data from the hardware tests (open-air tests, GMS, HITL, fuse, target signature, lab, and MESA) to determine the degree to which the digital models predict hardware performance. No database exists to evaluate the SA-6 hardware with performance of digital models. The planned tests will provide data that will contribute to system performance evaluation.

The primary objective of the M&S test series is to provide a database of digital simulation data that will determine the degree to which the models predict hardware performance. The methodology is to precisely replicate all hardware tests using the digital simulation. The data elements generated by the digital simulation will be compared with those generated from hardware testing.

The digital models will be tested in a series of open-loop tests in which each component model is executed in a stand-alone fashion. This will generate a database supporting the validity of each model by itself. Additionally, the component models will be integrated into the overall closed-loop simulation that will be executed to generate a database supporting the validity of the complete system simulation.

Endgame/Sensitivity Study (Pk)

JECSIM hardware and M&S test efforts will determine the degree to which the digital models predict hardware performance in terms of T&E MOEs. The Pk analysis will address the issue of how sensitive the lethality results are to endgame geometry and intercept conditions. The primary objective of the Pk sensitivity analysis is to provide a database of information that relates endgame input fidelity requirements to fidelity in Pk.

Planned Activities

JECSIM is scheduled to close 30 September 2000. The JECSIM JT will use the final year to disseminate legacy products and conduct final briefings. Additionally, JECSIM will complete program close-down transition activities, including placement of JT personnel, turn-in of equipment and property, and turn-over of facilities.

Legacy Products

The JT will identify the users of the legacy products and begin working a strategy to implement these legacy products at the conclusion of the JT. To outline the best way to implement the legacy products, the JT will prepare a JECSIM Legacy Products Implementation Plan, coordinate it with the Services and OSD, and forward it to the Deputy Director, Test, Systems Engineering and Evaluation/Test and Evaluation (DDTSE&E/T&E). Anticipated legacy products include the following listed below.

- ***Supporting Data for M&S Verification and Validation (V&V).*** The JT results will include extensive data on semi-active missile testing and Pk generation. These data can be utilized to support M&S V&V.

- ***Robust Data Set.*** A data set that can be used to identify M&S deficiencies and needed improvements will be acquired and stored.
- ***Integrated Set of M&S.*** The JT will determine, through sensitivity studies and requirements analysis, the need to hard-wire the different M&S together in order achieve the desired results.
- ***M&S Roadmap Guidance.*** JECSIM JT will provide additional insight into the need for refinement in physics-based modeling, M&S link requirements, configuration management, and V&V of the individual models.
- ***JECSIM Process.*** The process was established to demonstrate the capability of M&S to predict missile performance. The process will be identified and demonstrated for the semi-active missiles of the JECSIM JT, thereby extending the utility of M&S in T&E.
- ***Instrumentation Adequacy.*** As part of the JT, the team will address the adequacy of the instrumentation to collect the data needed to use the model.
- ***Assessment of M&S Capability.*** JECSIM JT will determine (1) the degree to which M&S, given T&E support to verify, predicts an actual missile engagement and (2) the sensitivity of Pk relative to end-game-related parameters.

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Joint Test and Evaluation Program
1999 Annual Report

Annexes

Joint Test and Evaluation Program Chronology

Number	Title	Year(s)	Remarks
1	Maverick (Combat Hunter)	72–73	
2	Test and Evaluation of Aircraft Survivability (TEAS)	72–75	
3	Air-to-Air Weapons Effectiveness (AIRVAL)	72–75	
4	Radar Bombing Accuracy (RABVAL)	72–75	
5	Electronic Warfare (EWJT)	72–76	
6	Airborne Target Acquisition (SEEKVAL)	73–76	
7	Hit Probability (HITVAL)	73–75	
8	Laser Guided Weapons Countermeasures (LGW/CM)	73–75	
9	Laser Guided Weapons in Close Air Support (LGW/CAS)	73–76	
10	A-7/A-10 Fly-off	74	
11	Close Air Support Command and Control ($CASC^2$)	74–76	
12	Forward Air Defense (FAD)	74–76	
13	Logistics Over-the-Shore (LOTS)	74–77	
14	Short Range Air-to-Air Missile (AIMVAL)	75–77	
15	Multiple Air-to-Air Combat (ACEVAL)	75–78	
16	Electro-Optical Guided Weapons Countermeasures/Institutionalized Counter-Countermeasures (EOGWCM/CCM)	76–85	Institutionalized as Precision Guided Weapon Countermeasures Test and Evaluation Directorate
17	Target Engagement (TEVAL)	76–77	Terminated due to funding priorities
18	Electronic Warfare during Close Air Support (EW/CAS)	76–82	
19	Tactical Aircraft Effectiveness and Survivability in Anti-Armor Operations (TASVAL)	77–81	
20	Imaging Infrared Maverick (IIRM)	77	
21	Data Link Vulnerability (DVAL)	77–85	

Number	Title	Year(s)	Remarks
22	Advanced Anti-Armor Combat Vehicle (ARMVAL)	78–81	
23	Identification Friend, Foe, or Neutral (IFFN)	78–89	TACCSF was a legacy.
24	Tube-Launched Guided Projectile (TLGP)	79	Army (lead Service) withdrew funding due to the existence of other similar efforts
25	Command, Control, and Communications Countermeasures (C^3CM)	79–89	
26	Central Region Airspace Control Plan (CRACP)	80–82	
27	Theater Air Defense (TAD)	81–82	Feasibility Study found that other non-JT&E programs were very similar and funding did not permit duplication of efforts
28	Joint Direction Finding (JDF)	81–82	Was not funded as a JT&E due to other higher priority projects.
29	Joint Forward Area Air Defense (JFAAD)	81–87	
30	Joint Logistics Over-the-Shore II (JLOTS II)	82–85	
31	Joint Air-to-Air Missile Concepts (JAAMC)	83–84	The feasibility study determined objectives were covered in the ongoing Advanced Medium Range Air-to-Air Missile (AMRAAM) program
32	Target Engagement Using Laser Designators (TELAD)	83–84	
33	Joint Chemical Warfare (JCHEM)	83–87	
34	Joint Live Fire (JLF)	84–91	The JLF Program continues today under the DOT&E Deputy Director for Live Fire Test and Evaluation.
35	Joint Over-the-Horizon Targeting (JOTH-T)	88–91	Identified development and acquisition needs to the JROC

Number	Title	Year(s)	Remarks
36	Joint Electromagnetic Interference (JEMI)	88–91	Institutionalized in ECAC, which is now the Joint Spectrum Center
37	Joint Crisis Action Test and Evaluation (JCATE)	90–91	Methodology transferred to DISA and used for JWID evaluations
38	Joint Suppression of Enemy Air Defenses (JSEAD)	90	Not funded as a JT&E due to higher priority projects.
39	Joint Logistics Over-the-Shore III	91-95	Established realistic planning factors for JLOTS operations
40	Joint Air Defense Operations/Joint Engagement Zone (JADO/JEZ)	90–95	Institutionalized in ASCIET
41	Smart Weapons Operability Enhancement (SWOE)	91–95	Developed capability to integrate measurements, databases, models, and scene simulations
42	Joint Camouflage, Concealment, and Deception (JCCD)	91–96	Developed TTP manual and databases of target attack results and materials requirements
43	Infrared Band IV Countermeasures (Band IV)	92–97	Produced databases on threat IR Band IV missiles and U.S. countermeasures
44	Joint Tactical Missile Signatures (JTAMS)	92–96	Developed missile signature measurement standards
45	Joint Theater Missile Defense (JTMD)	93–99	Institutionalized in JFCOM Joint Theater Attack Analysis Center
46	Joint Advanced Distributed Simulation (JADS)	94–00	On-going JT&E
47	Joint Combat Search and Rescue (JCSAR)	95–99	Produced training and exercise programs
48	Joint Electronic Combat Test Using Simulation (JECSIM)	96–00	On-going JT&E
49	Joint Combat Identification (JCID)	95	Mission taken on by the ASCIET program.
50	Joint Suppression of Enemy Air Defenses (JSEAD)	96–01	On-going JT&E
51	Joint Warfighters (JWF)	97–02	On-going JT&E
52	Joint Close Air Support (JCAS)	97–03	On-going JT&E; formerly Joint Night Close Air Support (JNCAS)

Number	Title	Year(s)	Remarks
53	Joint Theater Distribution (JTD)	98-02	On-going JT&E
54	Joint Shipboard Helicopter Integration Process (JSHIP)	98–02	On-going JT&E
55	Joint Cruise Missile Defense (JCMD)	99-04	On-going JT&E
56	Joint Global Positioning System Combat Effectiveness (JGPSCE)	99-03	On-going JT&E
57	Joint Battle Damage Effectiveness (JBDA)	99	On-going JFS
58	Joint Command and Control Intelligence, Surveillance, and Reconnaissance (JC2ISR)	99	On-going JFS

List of Acronyms

AAA	Anti-Aircraft Artillery
ACETEF	Air Combat Environment Test and Evaluation Facility
ACEVAL	Multiple Air-to-Air Combat JT&E
ACTD	Advanced Concept Technology Demonstration
ADS	Advanced Distributed Simulation
ADS	Airspace Deconfliction System
AFATDS	Advanced Field Artillery Tactical Data System
AFEWES	Air Force Electronic Warfare Evaluation Simulator
AFOTEC	Air Force Operational Test and Evaluation Center
AIMVAL	Short Range Air-to-Air Missile JT&E
AIRVAL	Air-to-Air Effectiveness JT&E
ALCOM	United States Alaska Command
ALS	Advanced Logistics Site
ALSA	Air Land Sea Application Center
AMC	Airborne Mission Commander
AMRAAM	Advanced Medium Range Air-to-Air Missile
ANG-CRTC	Air National Guard, Combat Readiness Training Center
AOR	Area of Responsibility
APA	Analysis Plan for Assessment
APOD	Aerial Port of Debarkation
APS	Advanced Planning System
ARMVAL	Advanced Anti-Armor Combat Vehicle JT&E
ASAS	All Source Analysis System
ASCIET	All Service Combat Identification Evaluation Team
ATACMS	Army Tactical Missile System
ATO	Air Tasking Order
AUSA	Association of the United States Army
AVTB	Aviation Test Bed
AWACS	Airborne Warning and Control System
BCD	Battle Field Coordination Detachment
BDA	Battle Damage Assessment
BF	Blue Flag
BMDO	Ballistic Missile Defense Organization
BSD	Battlefield Situation Display
BTS	Battlestaff Training School
Band IV	Infrared Band IV Countermeasures JT&E
C2	Command and Control

C3CM	Command, Control, and Communications Countermeasures JT&E
C4I	Command, Control, Communications, Computers, and Intelligence
C4ISR	Command, Control, Communications, Computers, and Intelligence Surveillance and Reconnaissance
CA	Combat Assessment
CAS	Close Air Support
CASC2	Close Air Support Command and Control JT&E
CAX	Computer-Assisted Exercises
CCF	Central Control Facility
CENTCOM	United States Central Command
CFL	Coordinated Fire Line
CFT	Captive Flight Test
CIC	Combat Integration Capability
CINC	Commander in Chief
CIS	Combat Intelligence System
CMD	Cruise Missile Defense
CONOPS	Concept of Operations
CONUS	Continental United States
CRACP	Central Region Airspace Control Plan JT&E
CRC	Control and Reporting Center
CRE	Consolidated Resource Estimate
CSAR	Combat Search and Rescue
CTAPS	Contingency Theater Automated Planning System
CTN	Common Target Number
DAST	Dedicated at-Sea Test
DD,DT&E	Deputy Director, Developmental Test and Evaluation
DDT&E	Deputy Director, Test and Evaluation
DI	Dynamic Interface
DIA	Defense Intelligence Agency
DIMSS	Dynamic Interface Modeling System
DIS	Distributed Interactive Simulation
DMAP	Data Management Plan
DME	Data Management Exercise
DOCC	Deep Operations Coordination Cell
D,S&TS	Director, Strategic and Tactical Systems
DSI	Defense Simulation Network
DT&E	Developmental Test and Evaluation
DTP	Detailed Test Plan
DTSE&E	Director, Test, Systems Engineering and Evaluation
DVAL	Data Link Vulnerability JT&E
DoD	Department of Defense

EADSIM	Extended Air Defense Simulation
ECM	Electronic Countermeasures
EEE	Electromagnetic Environmental Effects
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EOB	Enemy Order of Battle
EOGWCM/CCM	Electro-Optical Guided Weapons Countermeasures/Institutionalized Counter-Countermeasures JT&E
ETE	End-to-End
EUCOM	United States European Command
EW	Electronic Warfare
EW/CAS	Electronic Warfare during Close Air Support JT&E
EWJT	Electronic Warfare JT&E
FAD	Forward Air Defense JT&E
FLEX	Force-Level Execution
FPTOC	Force Protection Tactical Operations Center
FSD	Feasibility Study Director
FTX	Field Training Exercise
FWA	Fixed-Wing Aircraft
GMS	Ground-Mounted Seekers
GOSC	General Officer Steering Committee
GPS	Global Positioning System
GWEF	Guided Weapons Evaluation Facility
HITL	Hardware-in-the-Loop
HITVAL	Hit Probability JT&E
HLA	High-Level Architecture
HWIL	Hardware-in-the-Loop
IADS	Integrated Air Defense System
IFFN	Identification Friend, Foe, or Neutral JT&E
IIRM	Imaging Infrared Maverick JT&E
INTEL	Intelligence Community
IPR	In-Progress Review
ISR	Intelligence, Surveillance, and Reconnaissance
ITEA	International Test and Evaluation Association
J-MASS	Joint Modeling and Simulation System
JAAMC	Joint Air-to-Air Missile Concepts JT&E
JADO/JEZ	Joint Air Defense Operations/Joint Engagement Zone JT&E
JADS	Joint Advanced Distributed Simulation JT&E
JAOC	Joint Air Operations Center
JBDA	Joint Battle Damage Assessment JFS

JC2ISR	Joint Command and Control Intelligence, Surveillance, and Reconnaissance JFS
JCAS	Joint Close Air Support JT&E
JCATE	Joint Crisis Action Test and Evaluation JFS
JCCD	Joint Camouflage, Concealment, and Deception JT&E
JCHEM	Joint Chemical Warfare JT&E
JCID	Joint Combat Identification JT&E
JCMD	Joint Cruise Missile Defense JT&E
JCSAR	Joint Combat Search and Rescue JT&E
JDF	Joint Direction Finding JT&E
JECSIM	Joint Electronic Combat Test Using Simulation JT&E
JEMI	Joint Electromagnetic Interference JT&E
JFAAD	Joint Forward Area Air Defense JT&E
JFACC	Joint Force Air Component Commander
JFC	Joint Force Commander
JFCOM	United States Joint Forces Command
JFS	Joint Feasibility Study
JFX	Joint Fleet Exercise
JGPSCE	Joint Global Positioning System Combat Effectiveness JT&E
JIADS	Joint Integrated Air Defense System
JLF	Joint Live Fire JT&E
JLOTS	Joint Logistics Over-the-Shore JT&E
JLOTS II	Joint Logistics Over-the-Shore II JT&E
JLOTS III	Joint Logistics Over-the-Shore III JT&E
JOA	Joint Operating Area
JOTH-T	Joint Over-the-Horizon Targeting JT&E
JPT	JFACC Planning Tool
JROC	Joint Requirements Oversight Council
JSAS	Joint Forces Air Component Commander Situation Awareness System
JSAT	JSEAD Analysis Tool
JSEAD	Joint Suppression of Enemy Air Defenses JT&E
JSEM	Joint Services End-Game Model
JSHIP	Joint Shipboard Helicopter Integration Process JT&E
JSRC	Joint Search and Rescue Center
JSSA	Joint Services Survival, Evasion, Resistance, and Escape (SERE) Agency
JSTARS	Joint Surveillance Target Attack Radar System
JT	Joint Test
JT&E	Joint Test and Evaluation
JTAMDO	Joint Theater Air and Missile Defense Organization
JTAMS	Joint Tactical Missile Signatures JT&E
JTAV	Joint Total Asset Visibility

JTD	Joint Test Director
JTD	Joint Theater Distribution JT&E
JTF	Joint Task Force
JTFEX	Joint Task Force Exercises
JTMD	Joint Theater Missile Defense JT&E
JTTP	Joint Tactics, Techniques, and Procedures
JWF	Joint Warfighters JT&E
JWG	Joint Working Group
LFG	Live Fly Phase
LGSM	Light Ground Station Module
LGW/CAS	Laser Guided Weapons in Close Air Support JT&E
LGW/CM	Laser Guided Weapons Countermeasures JT&E
LIVEX	Live-Fly Exercises
LO	Low Observable
LOTS	Logistics Over-the-Shore
LSP	Linked Simulators Phase
Loc/Id	Location and Identification
M&S	Models and Simulations
MACA	Methodology for Assessment of C4I Architectures
MAGTF	Marine Air-Ground Task Force
ME	Mission Evaluation
MLM	Mission-Level Measures
MNS	Mission Need Statements
MOA	Memorandum of Agreement
MOE	Measure of Effectiveness
MOP	Measure of Performance
MOU	Memorandum of Understanding
MRC	Major Regional Contingency
MSC	Military Sealift Command
MSIC	Missile and Space Intelligence Center
MTW	Major Theater War
NAWCAD	Naval Air Warfare Center Aircraft Division
NAWCWPNS	Naval Air Warfare Center Weapons Division
NCBC	Naval Construction Battalion Center
NHA	Naval Helicopter Association
NIMA	National Imagery and Mapping Agency
NRO	National Reconnaissance Office
NTC	National Training Center
OAR	Open-Air Range
OITL	Operator-in-the-Loop
ORD	Operational Requirements Document

OSD	Office of the Secretary of Defense
OT&E	Operational Test and Evaluation
PACOM	United States Pacific Command
PTP	Program Test Plan
Pk	Probability of Kill
RABVAL	Radar Bombing Accuracy JT&E
RCS	Radar Cross Section
RESCAP	Rescue Combat Air Patrol
RESCORT	Rescue Escort
RF	Red Flag
RGFC	Republican Guard Forces Command
ROA	Restricted Operations Area
ROZ	Restricted Operations Zone
RV	Recovery Vehicle
RWA	Rotary-Wing Aircraft
SAC	Senior Advisory Council
SAM	Surface-to-Air-Missile
SARTF	Search and Rescue Task Force
SB	Surface Based
SEEKVAL	Airborne Target Acquisition JT&E
SERE	Survival, Evasion, Resistance, and Escape
SME	Subject Matter Expert
SOCOM	Unites States Special Operations Command
SOF	Special Operations Forces
SOUTHCOM	Unites States Southern Command
SPOD	Seaport of Debarkation
SUA	Special Use Airspace
SUT	System Under Test
SWOE	Smart Weapons Operability Enhancement JT&E
T&E	Test and Evaluation
TAB	Technical Advisory Board
TACCSF	Theater Air Command and Control Simulation Facility
TAD	Theater Air Defense JT&E
TASVAL	Tactical Aircraft Effectiveness and Survivability in Anti-Armor Operations JT&E
TCAC	Test Control and Analysis Center
TEAS	Test and Evaluation of Aircraft Survivability
TEL	Transporter-Erector Launcher
TELAD	Target Engagement Using Laser Designators JT&E
TEVAL	Target Engagement JT&E
TISD	Theater Integration Situation Display

TLGP	Tube-Launched Guided Projectile JFS
TPAT	Tactics Process Action Team
TRADOC	United States Army Training and Doctrine Command
TRANSCOM	United States Transportation Command
TSPI	Time-Space Position Information
TSST	Time-Sensitive Surface Targets
TTP	Tactics, Techniques, and Procedures
TTU	Terminal Transfer Unit
UFL	Ulchi Focus Lens Joint/Combined Command Post Exercise
UJTL	Universal Joint Task List
USCENTAF	United States Central Air Force
USCENTCOM	United States Central Command
USD (A&T)	Under Secretary of Defense Acquisition, Technology, and Logistics
USEUCOM	United States European Command
USFK	United States Forces, Korea
USJFCOM	United States Joint Forces Command
USPACOM	United States Pacific Command
USSOUTHCOM	United States Southern Command
USTRANSCOM	United States Transportation Command
V&V	Verification and Validation
VS	Virtual Simulation
VSTARS	Virtual Surveillance Target Attack Radar System
VV&A	Verification, Validation, and Accreditation

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